Progress in Material Welfare.

The address of Mr. Atkinson, as vice-president of Section 1 of the American Association for the Advancement of Science, at the meeting at Ann Arbor, has been published, and deserves attention. In his address Mr. Atkinson recognizes the great progress made in material welfare during the past 20 years, both in the production and the distribution of wealth. But he urges that we have no right to rest upon past achievements. During the past 20 years improvements have been mainly devoted to the increasing production and the cheaper distribution of food. With free commerce over a larger area and among a greater number of people than enjoy the same freedom in any other part of the world, it has come to pass, he claims:

1. That nowhere else are the products of labor and capital so ample.

2. Nowhere else are wages and profits so high.

3. Nowhere else is the cost of production measured in labor so low.

4. Nowhere else are high wages so sure to be the result and reward of a low cost of labor.

5. Nowhere else is so much general benefit derived from the expenditure of money raised by taxation.

6. Nowhere else is so small a part of the public income used for destructive purposes.

Mr. Atkinson refers especially to the increase in railway mileage which is partly a result of the Bessemer mode of making steel, and to the extraordinary progress made in securing cheaper transportation. The general use of the screw propeller has resulted in an enormous saving, and likewise the use of agricultural machinery, the opening of oil wells, the invention of aniline colors, the employment of electricity, the development of machine tools, and many other improvements to which he calls attention. Comparative safety from loss by fire has been attained by better construction of buildings. Attention is called to the progress already made in the use of phosphate deposits, and to the opportunity for almost unlimited increase in the use of such deposits at the West, and the salt deposits of Canada. In spite of all this, Mr. Atkinson maintains that the average product of the people does not exceed 50 to 55 cents per day for each person. The progress of invention or machinery has displaced a great number of workers for a time. On the other hand, the reaction from a period of unusual activity in railroad building has been displaced, he maintains, more than 100 000 persons formerly engaged in such labor. There is enough in the country for all, and yet there is little room for further saving in some directions—in the cost of transportation, for example—while in other directions there is still enormous waste, and especially in the distribution of perishable commodities.

Mr. Atkinson urges that the waste land of New England can probably be employed most profitably by use of the phosphates without nitrogenous fertilizers, and instances his own experience, stating that he has himself supported two cows every year from the product of 1 acre for five years past. He presents a body of interesting information regarding the use of cotton-seed, and the cost of raising cattle with pitted corn as a chief element of food, and believes that New England can yet raise animal food at a less cost than it can be produced in Texas, and can grow all the beef it can eat from its waste land, if the methods he discusses prove feasible.

Concerning the value of different articles of food in consumption, Mr. Atkinson presents tables prepared in part by Professor Atwater and by German scientists, showing the proportions of protein, of fats and of carbo-hydrogens in the different kinds of food in common use. In the same connection tables are given of the kind of food most largely employed in this and in other countries, and it is interesting to observe how the natural tastes of the people in many countries have led them to prefer articles of diet which contain in large measure or at the least cost, the chemical elements necessary to sustain life and to maintain strength for productive labor. The information on this subject which the address presents is too scientific in character for popular appreciation, but it is interesting to know that the Scotchman who prefers his oatmeal, and the New Englander who prefers his pork and beans, and the Southern negro who chooses above all things hog and hominy, all have a scientific reason for preferring, as the cheapest in proportion to the nutrition contained, the very kinds of food of which they seem most fond.—*Iron Age.*

Cost of Sweeping Streets in St. Paul, Minn.

City Engineer Rundlett has, during the summer, kept a careful account of the expense of sweeping the paved streets of St. Paul, by hand and by machine. The table for street sweeping by hand from May 11 to Aug. 1, is as follows:

Month.	Miles swept.	Cost.
May 11 to 30	46.69	$1,172 00
June	56.34	1,130 50
July	63.04	1,168 25
	166.07	$3,470 75
May, average cost per mile		$25 00
June, average cost per mile		20 18
July, average cost per mile		18 57
Total average cost per mile		20 00

This is the lowest average, the city engineer thinks, that can be touched by hand-sweepers.

BY THE MACHINE.

Aug. 1 the street sweeper made its appearance on the streets of St. Paul and was at once set to work. The first day 19,600 feet were swept, at a total cost of $20.75, or $10.37 per mile, and 6,950 feet at a total cost of $9.50, or $8.48 per mile. The tables from this on show a startling reduction in cost:

Total average cost per mile of sweeping by machine to date	$9 24
Total average cost by hand per mile	20 00
Miles swept by machine	39 25
Miles swept by hand	166 07
Total cost by machine	$360 37
Total cost by hand	3,470 75

The city engineer considers these statistics and the condition of the streets self-demonstrating as to the value of machine work and its economy. The apparatus is working day and night and doing excellent service. The purchase of others, and better ones, is only a matter of time.

Driving Headings Without Explosives.

In driving a stone drift at the Bois de Boissu colliery, in the Mons district, Belgium, the stratum was found to be so charged with fire damp that it became impossible to continue the use of explosives. Recourse, was therefore, necesarily had to other means of carrying on the driving. The system adopted has shown itself to be adequate to the circumstances of the case, and is worthy of mention as a successful solution of a somewhat difficult problem. The rock was a very hard grit, lying in horizontal beds. A machine drill, of the Dubois & Francois type, was employed on the face of the heading in the following manner: Across the middle of the face a row of holes were bored, from 3 to 4 inches in diameter and 3 feet deep, the distance of the holes apart being from 5 to 6 inches. When all these holes had been bored a special tool was substituted for the drills, having a rectangular striking surface 6 inches long by 2 inches wide, and provided with teeth like a saw. By means of this tool the rock left between the holes was cut through leaving a horizontal groove, varying in width from 2 inches to 6 inches, and of a depth of 3 feet, extending across the face of the heading. This groove was intended to serve the same purpose as the "holing" or undercutting in coal. Other holes of smaller diameter were then bored above and below the groove, and in greater or less proximity to it, according to the strength of the rock. Conical iron wedges of slow taper, placed in these holes and driven in by the machine drill, provided with a hammer for the purpose, broke down the rock between the holes and the groove. These operations were continued until the whole face had been brought down, when an advance had been made of about 2 feet 8 inches. This advance varied with the nature of the ground, and still more with the skill of the workman, who did not attain to the average length of 2 feet 8 inches till after they had acquired considerable experience in this system of working. The shifts, which were of eight hours, consisted of three men, one in charge of the drill, and two laborers. The driller worksd 18 consecutive hours. The average rate of progress made under these conditions was 8 feet 2½ inches a week, the section of the heading being 6 feet 11 inches by 7 feet 2½ inches. When the special difficulties of this driving are taken into account, this rate of progress must be considered satisfactory.

An English Contract Case.

An action against a corporation, such as a local board, is sure to fail if the agreement has not been sealed. Some architects and contractors know this by sad experience. But it is very different when the action is taken by the board, for in that case a sealed deed is unnecessary. The difference was illustrated by an action which was tried at Lewes recently. In November, 1881, a contract was entered into by the Tunbridge Wells Commissioners with one Porter, for the construction of a reservoir, the amount being 16,900*l.* A sum equal to 10 per cent. on the first sums due was to be retained until after the year of maintenance had expired. The contractor proceeded with the works up to March, 1883, when he had done work to about the value of 5,000*l.*, and the engineer had certified to the amount of 3,141*l.*, leaving, as the contractor alleged, nearly 1,900*l.* still due to him. He was unable to complete the works, and a second contract was entered into with a different contractor for the remainder at 12,187*l.* While Porter was employed he purchased stone from the Commissioners of the value of 220*l.*, and it was to recover that sum the action was taken. He set up a counter-claim for the balance that was due to him. The Commissioners maintained against the counter claim their right to 1600*l.*, being 10 per cent. on the contract amount. Defendant's counsel said that the 1,600*l.* was to be taken as "paid," although retained. But Baron Huddleston decided that the words of the contract deed when providing for a failure "and the amount then already paid to the contractor by the local board shall be considered the full value of the works executed by the contractor up to the time when the notice shall have expired; and no further claim shall be made by him for contract works or additional works which may have been done by him up to that time"—must be interpreted in the plaintiffs favor. A plea was then tried to be set up that the contract was void, not being under seal, but it was argued that the contract for the stone was at common law, and not under the Public Health Act. That view was adopted by the learned judge, and accordingly judgement was given for the plaintiffs on claim and counter-claim.—*London Architect.*

ENGINEERING NEWS, Three Months for One Dollar.

The Government Improvements at Hell Gate, New York Harbor.

The original condition of the immediate channel at Hell-Gate was as follows, reference being made to Fig. 2:—The depth at low tide over Frying Pan was 11 ft.; over Pot Rock 20 ft.; over Heel Tap, 12.1 feet, and Hallet's Point, from the shore at Astoria, projected under water 325 to the 26 foot contour line at mean low water and included an area of about 3 acres. The Middle Reef, including Flood Rock, Negro Head and the Gridiron, covered an area of 9 acres above the 26-foot contour, and a small backbone projected above high water. It was the position of this reef with reference to the original Hallet's Point that made navigation in their vicinity exceedingly dangerous: the entrance to the East River, by the channel between them, was by an almost rectangular bend, and if one was avoided the danger of falling upon the other was thereby increased.

The history of the government improvements of the Hell-Gate channel dates back to about 1848, when Lieutenants Porter and Davis first recommended the removal by blasting of the dangerous obstructions of Pot Rock, Frying Pan and Wav's Reef. In 1852, Congress appropriated $20,000 and expended $18,000 on the Pot Rock in surface blasting by the Maillefert process, and by so doing increased the depth over the rock from 18.3 to 20.6 feet.

Nothing further was done at this point until 1868. In 1867, Gen. John Newton, now Chief of Engineers, made an examination of the obstructions and reported a plan for removing them and the obtaining of a channel of entrance of navigable width, and not less than 25 deep at low water.

By act of Congress of July 25, 1868, $85,000 was appropriated for work at this point, and in 1869 operations were commenced upon Diamond Reef. A drilling scow was constructed for this purpose, having a central well-hole 32 feet in diameter through which 21 drills were operated. Holes from 7 to 13 feet in depth were drilled; these holes were charged with from 30 to 35 pounds of nitro-glycerine, and the broken rock removed by dredging. In 1871, 93 holes were drilled and blasted in Coenties Reef, and in 1872, 17 holes and 11 surface blasts were made on Frying Pan Rock. In 1873, further work was done upon these smaller reefs; and by that time 307 holes had been drilled and 39 surface blasts made, consuming a total of 17,127 pounds of nitro-glycerine.

In 1869 work upon Hallett's Point was commenced by first building a heavy coffer-dam of timber next to the shore and fastened to the rock by bolts. When this dam was made tight and pumped out, a shaft was sunk to a depth of about 33 feet, and from this shaft ten radiating headings were started out under the reef, intersected by numerous cross galleries conforming with the general outline of the rock. The average length of these headings was 270 feet, and the total length of headings and galleries was 7,426 feet; 173 piers, each about 10 feet square, were left to support the roof. The detailed survey of 1871 gave the cubic contents of the rock above the 26-foot contour as equal to 51,000 cubic yards. 47,461 cubic yards were removed by the excavations, much of this however was below the 26-foot line. In June 1876, the work of excavation was completed, and 3,676 holes, from 2 to 3 inches in diameter were drilled into the pillars and the roof to an average depth of 9 feet. These holes were then charged with cartridges about 3 inches in diameter and from 9 to 24 inches long, one or more being put into a single hole as occasion demanded.

A total of 47,781 pounds of dynamite, or its equivalent, was used in charging the holes; the charges being arranged in 184 battery groups of 20 charges each. The battery used in exploding the mine was placed in a strong bomb-proof near the shaft, and consisted of 960 bichromate of potash cells, the zinc and carbon plates opposing an area of about 40 square inches each to the fluid.

The great explosion took place on Sunday, September 24, 1876, and while it was very effective as to work done, many of the spectators were disappointed at the comparatively slight commotion produced by the firing of what was to that time the greatest quantity of explosive ever attempted in a single operation. No damage whatever was done to the nearest building, though a slight tremor was detected on the line of the rock formation, to a distance of 10 and 13 miles, but very delicate instruments were required to record it.

In Fig. 1 we have given a general map of Hell Gate, with reference to the City of New York and its surroundings, and we do this by reason of the rather surprising ignorance existing, even among residents of New York, as to the precise location of these very important government operations. The point which is soon to be so much talked about in the daily press, will be found at the intersection of the East and Harlem Rivers, and what we may call the entrance to Long Island Sound, although the conventional limits of the Sound are still some miles further east.

In Fig 2, we have an enlarged map of the immediate vicinity of Hell Gate; the reefs shown in solid black have already been operated upon, and removed generally to the 26 foot contour, although in one or two of the smaller ones this limit has not yet been quite reached, some loose rock still remaining to be dredged. The cross-lined reef is the famous Flood Rock soon to be blown up. Lying as it does, just at the outer edge of the sharp bend in the Eastern Channel, and with certain points projecting even above high water, this was always an eminent source of danger to navigators, and it has been the cause of innumerable wrecks.

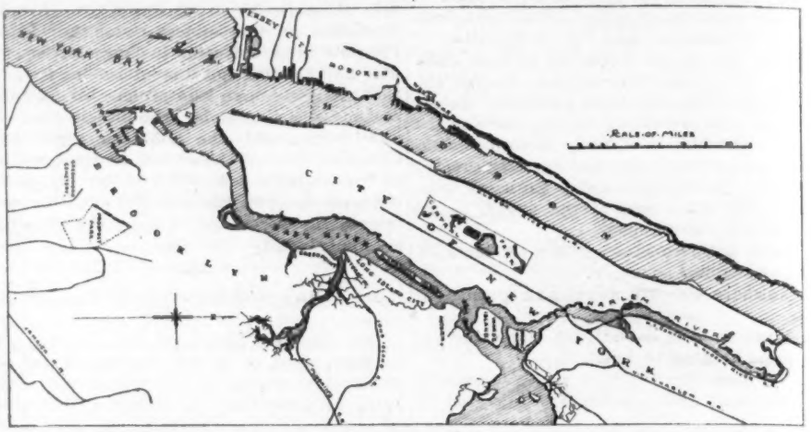


FIG. 1. SHOWING GENERAL LOCATION OF HELL GATE WITH REFERENCE TO NEW YORK.

In the original plan of Gen. Newton, it was contemplated to tunnel both Flood Rock and Hallet's Point; but the Board of Engineers, fearing the enormous outlay, and doubting somewhat the feasibility of the scheme, as extended over nine acres of area, concluded to blow up the projecting Hallet's Point, and to only build a training wall on the channel side of Flood Rock. But the successful nature of the operations at the Point changed the minds of the Board, and in 1875 Gen. Newton's original plan was virtually adopted, and work was inaugurated upon Flood Rock by commencing the sinking of a shaft. With many delays incident to congressional methods of granting appropriations, this work has been continued to within the present year.

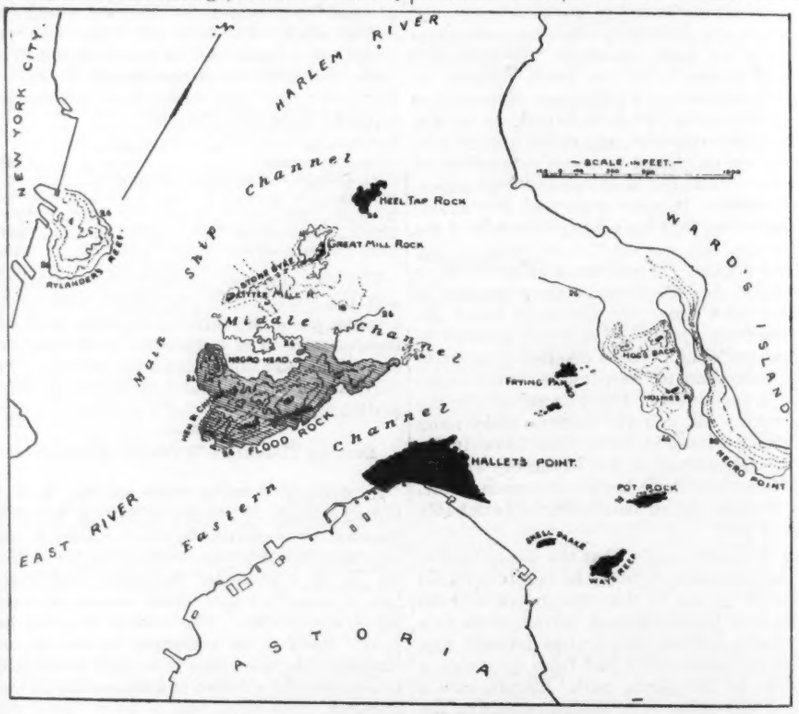


FIG. 2. HELL GATE AND ITS SURROUNDINGS.

The excavation was virtually finished in 1883, but the failure to grant an appropriation for 1884, compelled the useless expenditure of $30,000 for simply keeping the works intact, and ready for the reception of the explosive now being put in place.

Flood Rock to the 26 feet contour, is about 1,200 feet by 625 feet in its longest dimensions, and covers an area of somewhat in excess of 9 acres. Operations were commenced by forming an artificial island about the highest portion of the rock. (The ultimate limits of this island are shown in Fig. 3, by the heavy line surrounding the shafts.) Within these

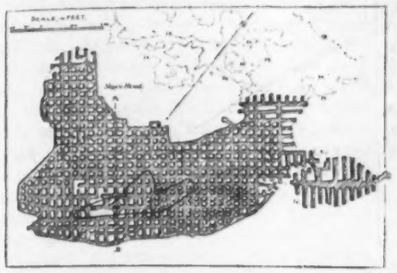


FIG. 3. FLOOD ROCK: SHOWING ARRANGEMENT OF GALLERIES.

limits shafts were sunk, and the galleries gradually extended to the desired extreme points. This portion of the work differed little in its execution from ordinary tunnel excavation, save in the extreme care required in defining the gallery limits towards the rock surface. To successfully accomplish this, many thousand soundings had previously been taken, and every portion of the rock surface accurately ascertained and mapped with reference to a fixed datum plane. Leakage from crevices in the rock was of course abundant, but when possible, these cracks were plugged, and all surplus water discharged by heavy pumps. The deepest excavation below mean low tide extended to 64 feet in the sump at the foot of the main shaft; the average gallery floor is about 50 feet below the same datum. It might be well to state here that the expression "26-feet contour" frequently used, means a plane 26 feet below mean low tide, and it is the intention of the government to give this clear depth of water over all the points of rocks indicated in Fig. 2.

As the rock stands to-day, it is perforated by nearly four miles of tunnels in aggregate length, or exactly 21,670 feet. The shell of rock necessarily left between the galleries and the water varies in thickness from 10 feet to 24 feet, as the conditions required. To support this roof there are left 467 rock columns, each about 15 feet square, and varying in height with the galleries. As the experience at Hell Gate has proven that it is more economical to break up the rock and remove it by dredging, than to remove the greater part by tunneling, the officers in charge at Flood Rock have only regarded the galleries as means of drilling and charging the rocky shell. As a consequence, 13,286 holes have been drilled into the pillars and roof of the galleries; these holes will average 9 feet in depth, and in the columns are about 5 feet apart, and in the roof 4 feet; they are 3 inches in diameter. The total quantity of rock excavated in driving the galleries, etc., was 80,166 cubic yards; and in the pillars and roof now standing there is about 275,000 cubic yards more.

The rather delicate operation of charging these holes with the explosive to be used is now in progress. The exact total quantity, which will finally be stowed away in Flood Rock is not known to the public; the general estimate ranges from 275,000 to 300,000 pounds, though we should judge from the aggregate length of hole stated above that the larger quantity is nearer the correct amount. So many wild prophecies and wilder guesses emanated from the average press reporter in 1876, as to the woeful results to be expected from the explosion at Hell Gate, that General Newton has now wisely left this item of quantity to their own vivid imaginations.

The explosives to be used are rackarock and dynamite, No. 1, in the proportion of about eight volumes of the first to one of the last. This rackarock is a mixture of chlorate of potash with dinitro-benzole; these ingredients are harmless in themselves and are delivered separately to the authorities on Great Mill Rock, near the Flood Rock. Here the compound is made under the careful supervision of experts and the government officials. The operation of charging the cartridge cases is conducted as follows: These cases are made of thin copper, and are each 24 inches long and 2½ inches in diameter; each one hold six pounds of the rackarock. The potash and benzole are mixed intimately in a lead-lined vat in the center of the mixing-room, the potash being made to pass through the meshes of a fine seive and the benzole then added in the requisite proportions; around three sides of the room are the men who pack the powder into the cases, each man having a hod-like receptacle before him filled with the rackarock, which looks like a moist light brown sugar; the powder is tamped into the case with light wooden rammers. As each case is filled, it is tallied and passed to the fourth side of the room where it is subjected to a process that at the first glance somewhat startled our reporter, as he realized what was going on at his elbow, and that was the soldering by heat of a head into each of the cases filled with six pounds of an explosive that has 95 per cent. the strength

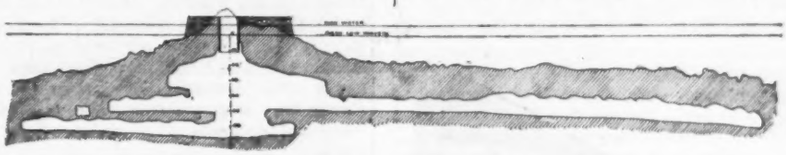


FIG. 4. SECTION OF FLOOD ROCK ON LINE A. B. FIG. 3.

of dynamite No. 1. But close inspection showed that this result was attained by steam heat, limiting the degree of heat to about 112°, and thus securing a very considerable margin of safety between that and the exploding point of the rackarock. As delivered, each case has around its neck a slight coating of a very fusible alloy, and a thin plate covered with the same compound is dropped upon a narrow ledge in the neck of the case, and both then applied for a few moments to the steam-heated cup and the case is hermetically sealed. By standing the case upside down for a time the slightest leak may be detected by the escape of the highly volatile oil. When tested as to weight and duly checked off, the filled cases are deposited in cellular boxes and are ready to be transported to the galleries; at the bottom of each case are soldered four short brass wires intended to steady the case in the bore-hole and, as a guide, insure regular contact between any two cartridges.

In drilling the holes in the roof and pillars an exceedingly careful record was kept of the length and direction of each hole, and each when finished was plugged by a numbered wedge, which indicated its location on the charts. In loading these holes, a car is used surmounted by moveable frames that can be built up one on the other until the highest parts of the roof can be reached. The six-pound rackarock cartridges are first inserted, and with these there are no primers, but when these cases, as required by the length of hole, are in place, a copper case containing three pounds of dynamite No. 1, is put in on top, and the whole charge is fired by concussion only as near as we can learn. In the Hell Gate explosion, each drill hole had its primer and battery wire, but as the wiring alone of the Flood Rock charges, in a similar manner, would have cost about $50,000, Gen. Newton has, after careful experiments and tests, divised a more economical but quite as efficient method of securing a perfect explosion. The details of this new system will be fully described by Gen. Newton at the proper time, but for the present they are withheld from the discussion of laymen.

The loading of the holes is now progressing at the rate of about 5,000 pound of powder per day, according to report, and, somewhere between October 1 and 15, are expected to be ready for the final explosion. Before this time arrives the machinery, etc., will be removed from Flood Rock and the artificial island of rock also much reduced in size. After the rocky shell is broken up, all remaining above the 26 foot contour plane will be dredged out, an operation that will doubtless consume a very considerable length of time; but, when it is done, ocean steamers can safely enter the East River by way of the sound, as far as a sufficient depth of water is concerned: although, prevailing fogs and the abundance of light craft in that sheet of water will, as before, prevent this from becoming a general route for ocean liners.

The entire cost of the improvement of the channel at Hell Gate can not be clearly deduced from the official report; nor are the engineering authorities responsible for much of the money there expended. The usual Congressional delays in granting appropriations, or in limiting to insufficient amounts the expenditures of each fiscal year, are not conducive to economical work. Letting the work by contract under such conditions was practically impossible, except at relatively enormous figures, and though contract work was, we understand, attempted, the trial ended in failure. The original estimate for "Removing reefs at Hell Gate and Diamond and Coenties Reef" was $5,139,120; of this amount, $3,136,945 had been expended to June 30, 1883, the last report at hand. This expenditure includes all the work done at the points named since 1868, and current report puts the estimated cost of the completed improvement at Flood Rock at $1,000,000. As to detailed cost, we find from the annual reports of the Chief of Engineers that the cost, at Flood Rock, for removing one cubic yard of rock in a heading 6 by 4 feet was about $10,00 and the stoping cost $4.00 per cubic yard; this included all charges incidental to the work, and taking the report of June 30, 1883 as an example, with the heading costing $10,239, the items stand about as follows per cubic yard:—Drilling, $6.652; blasting $1.684; pumping, $0.623; ventilating, $0.29; timbering, $0.077; transportation, $0.132; surveying, $0.355: superintendence $0.687. For stoping the same items cost, taking them in the same order:—$2.831; $0.645; $0.273; 0.017; $0.034; $0.058; $0.156: $0.301; total, $4.31 5/16 per cubic yard. The cost of a linear foot of 2-inch hole, in 1883 report, was, for heading, $0,341; and for stoping, $0,431; the 3-inch hole cost $0,535 per lineal foot. In a shift of eight hours each machine drilled 22.98 feet of 2-inch hole and 19.49 feet of 3-inch hole, in 1883. The pounds of explosive used per cubic yard of rock broken was, in the 10 by 6 feet headings, 3.62 pounds; in stoping, 1.39 pounds. In the above record the total quantity of rock broken and removed during the fiscal year, was only 516 cubic yards in stoping, in a total of 14,202 cubic yards; this small quantity accounting in a measure for the relatively high price per

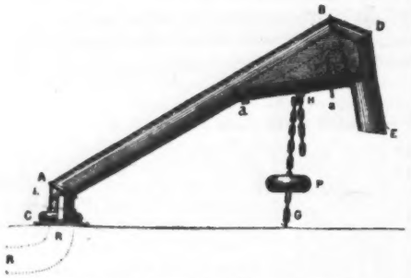
item. The total expenditure for "excavation at Flood Rock," in year ending June, 1883, was $161,894.02.

The improvements at Hell Gate have been under the charge of Gen. John Newton, now Chief of Engineers, since the commencement of operations; and, taking into consideration the conditions under which the work has necessarily been accomplished and the difficult nature and unprecedented magnitude of the submarine excavation, he has every reason to be satisfied with the results so far attained. Although the present scheme ends with the blowing up and removal of Flood Rock, the great and Little Mill Rock reefs will doubtless be ultimately removed and the dangers of Hell Gate will be a tradition of the past. The present plan however, does contemplate the removal of a rock, now being worked upon, off Negro Point (see Fig. 2) and the erection of a training wall along the southwest coast of Ward's Island on about the 26 foot contour, and also the removal of Rylanders Reef on the New York City side.

We are especially indebted for information here used to the courtesy of First Lieut. George Mc C. Derby, U. S. Engineers, who has been in direct charge of the Flood Rock excavations for some years, and has frequently been recommended in the report of the Chief of Engineers for his efficiency and energy in connection with this work.

An Automatic Syphon for Irrigating Purposes.

Le Genie Civil describes an automatic syphon for the emptying of collecting reservoirs in an irrigation district. It is the invention of a Mr. Giral, of Laugogne, France, and the main advantage claimed is that it will charge even when the source of supply is very feeble.



AUTOMATIC SYPHON; GIRAL SYSTEM.

This apparatus (see figure) is formed of a bent pipe of galvanized iron, C A B D E; the end C communicates with the delivery canal R, and is connected with this pipe by a special form of rubber joint which permits the upper end to revolve around the axis K and yet keep the pipe hermetically sealed.

This rubber joint is made somewhat like the bellows of a musical instrument and carries a galvanized-iron ring to which the syphon is attached; on a lower plate are two journals which confine the lower ends of two flexible bridles K L riveted to the syphon-pipe at their upper ends. All of these metallic portions are made of galvanized iron.

Between the branches A B D E of the pipe, is soldered a sheet of galvanized iron, which forms an independent air reservoir F, pierced at its upper portion by a small hole *b* which always remains open; on the lower side of this reservoir are placed a screw-plug *d* and a galvanized hook H.

In the inside of this chamber is a small leaden syphon *a b c*, with the long leg *a* passing through the bottom where it is soldered fast and the short branch *c* coming down almost to the bottom. Finally there is a galvanized iron chain G H, fastened to the bottom of the reservoir at G, and provided with the weight P; this chain and weight regulate the height to which the syphon can rise in the reservoir,

The apparatus works as follows: As the water rises in the reservoir, the syphon is immersed and gradually "loses weight," and the end B D H is raised up, turning on the journals at K, until the chain G H is stretched. The tube then stops, but the water always rising, finally reaches the summit *b* of the small syphon, and through this small pipe fills the air-chamber F. The equilibrium is broken by this added weight and the main syphon plunges to the bottom, fills itself and empties the reservoir.

When the water level, in falling, reaches the small syphon *a b c*, which is already charged, this syphon commences to work and empties in its turn the air reservoir, so that just when the main syphon ceases to work the whole apparatus rises again to the position previously occupied and under the same conditions.

This simple and inexpensive apparatus is succesfully used for irrigation purposes on several of the prairies in the lower valley of the Allier, in France.

Steel for Shipbuilding.

Mr. Jeremiah Head, a well-known English ironmaster, has recently reviewed the question of the use of steel in shipbuilding in a very able manner in his inaugural address as president of the British Institution of Mechanical Engineers, in which he spoke as follows:

Steel, as now made to Lloyd's requirements, is superior to iron for shipbuilding purposes for two reasons, which I am inclined to consider of primary importance, namely: 1. It is very much more ductile. 2. It is equally ductile in both directions of the grain. To these reasons may be added three others, which I look upon as of secondary importance, namely: 1. It has 30 per cent more tensile strength in the direction of the grain. 2. It has 50 per cent. more across the grain. 3. Its elastic limit is 21 per cent. more in either direction of the grain.

I have placed tensile strength and elastic limit in a secondary position as compared with ductility, because in the former respect iron has always proved itself at least equal to the ordinary demands upon it. Indeed, the examples of the Great Britain steamship, built in 1845; the John Bowes, in 1851; the Great Eastern, in 1857, and many others still afloat, prove that if a well-built iron ship be kept off the ground and free from collisions its life is practically unlimited. Serious collisions have the same disastrous result, whether iron or steel be the material concerned. The circumstances wherein steel most strikingly shows its practical superiority are when minor accidents occur, such as slight collisions, grounding in moderate weather, and so forth. In such cases steel ships have repeatedly remained tight, and returned safe, though in a battered condition, when had they been of iron, they might probably have become total losses.

The benefits of marine salvage, however, usually accrue to the underwriters, and not to the shipowner. The former have an obvious interest in saving to the utmost, while the latter may even gain by the loss of his ship. Apart from humanitarian considerations, no fully insured owner would wish to recover his ship in a seriously damaged condition. Nevertheless, it is the owner who decides the material to be adopted, and not the underwriters. Should the diminution of risk by the use of steel be accurately determined in the future, and the insurance premiums be adjusted accordingly, then it may become the owner's interest more clearly than it is at present to specify the more ductile material. Up to the end of 1883 steel could not be said to have superseded iron at all in shipbuilding. For although 166,428 tons of steel shipping were made in that year under Lloyd's survey, still the tonnage of iron shipping surveyed during the same year was 933,774 tons, or considerably greater than any previous year. So far, therefore, the steel used was in addition to and not in replacement of iron.

In the disastrous year 1884 the total tonnage built was 28 per cent. less, while the tonnage of steel shipping built was 132,457 tons, or 20 per cent. less, and of iron 661,201 tons, or 29 per cent. less, than the previous year. Had there been no such material as steel all would doubtless have been built of iron. We must therefore consider that the proportion of steel shipping to that of iron shipping built last year is the proportion in which the latter had then become superseded. That proportion is about 20 per cent., or one-fifth. During the first half of 1885 steel vessels amounting to 67,469 tons has been built to Lloyds' survey, out of a total of 221,423 tons, or 30 per cent., showing a continued progress in the gradual supersession of iron by steel. The practical question whether to adopt steel or iron, which shipowners must decide before commencing to build, involves some rather curious considerations. Relying upon the circumstance that 30 per cent. more tensile strength could be obtained in steel than in iron, and with the experience gained by a series of experiments, Lloyds' committee agreed in 1877 to allow for the stronger metal a maximum reduction of 20 per cent. in weight of scantlings, and issued rules accordingly for the general guidance of ship builders.

A structure built under such conditions might be supposed still to have a margin of 10 per cent. excess of strength. But such reasoning would be misleading, because certain elements which ought to be included in the calculation are omitted. If a piece of metal, such as an iron or steel plate, be strained as a girder, it gives way by bending when the tensile strain on the outer surface, or the compressive strain on the inner surface, exceeds the respective elastic limits. Power of resistance to compression is therefore of such importance in cases of bending that only in so far as this holds out is tensile strength of any avail. To neglect compression is like attempting to use a lever with a yielding fulcrum. Again, still looking upon a ship plate as a broad girder, we shall find that resistance to bending is in proportion to the square of the depth of the girder—that is, the thickness of the plate. For example, if two pieces of plate of equal width and length, and $\frac{3}{4}$ inch and $\frac{1}{2}$ inch thick respectively, be laid upon supports and weight be placed upon them, the first will be found to sustain more than the second in the proportion of 5^2 to 4^2, or 25 to 16—that is, the thinner piece will sustain 36 per cent. less than the thicker ones. If the former were steel, and therefore stronger on that account by 30 per cent. than the latter, say, of iron, still it would be weaker in the proportion of 30 to 36 by reason of its diminished thickness. It therefore becomes clear that an iron ship is likely to retain its form better than a steel one built 20 per cent. lighter.

It is but just to Lloyd's committee to point out, that, while permitting a reduction of thickness of 20 per cent. in steel ships, they insisted on, and have invariably enforced, a system of testing and inspection far more severe and rigid than was ever applied to iron ships. All the steel used must support a tensile strain of between 27 and 31 tons per square inch in any direction, besides a quenching test. And whatever does not fulfil these conditions by ever so little is relentlessly rejected.

The sudden transition from the comparatively easy going inspection, which iron for shipbuilding receives, to the severity of that of steel, is of itself suggestive that Lloyds' committee have for long been themselves apprehensive that 20 per cent. is far too great a reduction

to allow. They seem, in fact, to say to the shipowner; "if you will avail yourself to the utmost of our permission to reduce thicknesses, in order to cheapen the cost of the ship and carry somewhat heavier cargoes, you may do so. But we will watch that not a piece of steel is used which has not the very highest degree of tenacity, attainable short of liability to brittleness." During the last seven or eight years, evidence has not been wanting to confirm the suspicion that the 20 per cent. reduction was too great even as a maximum. It is not easy to obtain exact particulars or definite cases, inasmuch as those who are best informed, naturally refrain from proclaiming what might tend to depreciate their own work or their own property. But I am informed on authority, which I have no reason to doubt, that there have been cases of steel ships returning from voyages, more or less strained, and out of shape, in a way rarely experienced previously. Other cases, where it has been found necessary to strengthen the ship externally after completion, in order to avert anticipated difficulties of the same kind, and one case where the position of each frame could be traced by the eye from the outside, owing to the places bulging inward from external pressure.

The Decay of Stone on the Ground Level.

The decay of stone on the ground level of buildings is a subject of great importance and anxiety to those responsible for substantial erections in this material; for in many instances, before the work can be got out of hand by the contractors, signs of disintegration present themselves, and before many years have passed the evil has intensified to such an extent that the lower parts of the building are in a state of decay bordering upon ruin. The same evil presents itself in connection with old buildings, and it is invariably the case that this dissolution in the lower part of the building hastens the process of disintegration over the whole fabric.

This detail of decay in stone is traceable in a primary sense to asorption of water from the foundations, but in a secondary sense to a variety of causes. Absence of a damp-course, as in old buildings, is a prime cause of this decay of stone on the ground line, and inefficient damp-course is a secondary cause. These are intensified by thick walls, filled in with rubble and grout, backed by a damp or humid atmosphere. In some cases it is accelerated by the finished ground being inadvertently brought above the damp-course, or by stone paving brought up to its level wherein the beating rain gets access to the superstructure. The character of the stone used in the building of a house is an important factor. A porous sand-stone, like the millstone grit of the Carboniferous system, is extremely durable; whilst a porous limestone, like the Bath and Ancaster stones of the Oolitic system, is extremely perishable. The reason of this is not far to seek, for the cementing medium in the sandstone is silica, impervious to the action of water travelling to the face of the stone to evaporate in the rarefied atmosphere; while the cementing medium in the limestone is carbonate of lime, more or less in a state of crystallization, but nevertheless more or less solvent in water, containing as it does, in important centres, a dangerous amount of carbonic acid. In the former case the stone will give out its water without ruin being stamped upon its face, whereas in the latter the mineral matter, unable to pass into the air, will crystallize on the outer face or skin, an operation that will mark the decay of the stone by disintegration.

In a humid climate like England, stone, independently of its connections with the foundation of a building will, during half the year, be conducting the process of absorption. This is an operation so well known that stone walls have an unenviable character for their dampness, a character that invariably causes them to be built hollow, or lined with brick or a framework of wood. The same stone, during the summer season, will be giving off its stored-up moisture, an operation of no moment on the north side of a building, where the absorbing power of the sun is not experienced, but one that on the south side will be carried to a great and dangerous extent.

It is to the absence of the sun on the north side of a building, and the uniform character of the moisture in the stone, that it is always in a better state of preservation than the south side, and it is to the presence of the sun on the south side, and the extremes of moisture, heat and dryness experienced by the stone, that it is invariably found in a decayed or ruinous state. The moisture present in the north and south walls of a building in the winter or humid season is identical, the reverse being the case in the summer, for the north wall, if the surroundings are favorable, will be coated with moss or lichen, whilst the south wall will be dry and arid. It is to this high or active state of evaporation in the sun that the decay of stone on the ground line is, if not actually brought about, certainly accelerated. So much is this the case, that if we examine the north wall of a building we shall find the line of disintegration on the ground level scarcely marked, while the line on the south or other sides exposed to the influence of the sun, illustrates an advanced state of decay. It naturally follows that special attention should be brought to bear on all but the north sides of a building; the damp-course should here be most effectual, and the walling upon it placed above any possible contact with the ground, or the influence of beating rains.

The ashlar work should be constructed in a stone whose power of absorption is of a low order, for it is to the large measure of absorption, and evaporation in the absence and presence of the sun that dissolution is brought about. In carrying out this policy, care should be exercised in avoiding all projections, recesses etc., which collect and distribute water, on what is known as the drip principle, a principle most markedly at variance with the preservation of stone. If these features are imperative, arrangements should be made for collecting and removing the water, a thing by no means impossible where wall pipes are introduced in connection with the roofs. If a porous stone is used, more especially if it be limestone or dolomite, we advise the coating of the same with preservative composition, a material, on the one hand, that prevents undue absorption, and, on the other, undue evaporation.

In giving this advice we are not unmindful of the fact that it gives to the stone a paint-like surface for a time: but it has proved so efficient in the extensive restorations carried out on the south side of of York Cathedral, by the late and lamented G. E. Street, that we have no hesitation in advocating it,—*W. S., in the Building News.*

Chicago Sewers and Death-rate.

As the cholera epidemic in 1849-50 led directly to the introduction of lake-water and the foundation of what is in some respects now the most magnificent system of water supply in the world, so the repeated epidemics of cholera and dysentery led to the adoption in 1856 of a system of sewerage which within twenty-four years thereafter had furnished more linear feet of sewers per capita popular then any other of the large cities of the Union. For fourteen years (1843-56 inclusive) the average annual death rate of the city had been 37.91 per thousand, probably the highest of any city in the United States; during the first fifteen years of sewer construction (1856-1870) the average annual death-rate was reduced to 23,97 per thousand, while from 1872 to 1884 inclusive the average has still further fallen to 21.40 per thousand. And although there have been marked fluctuations from year to year—rising to 32.22 in 1866, and falling to 16.49 in 1878—on the whole there is a striking correlation between the annual death-rate and the number of feet of sewers per capita year by year, independent of all other influences.—*Science* (sanitary number).

Mr. Petrie on the Great Pyramid.

Mr. Petrie is minute in his observations of the injury that the King's Chamber, the chamber containing the sarcophagus in the Great Pyramid, has sustained, apparently by an earthquake. The joints of the stones have been loosened on every side, and the great beams of the ceiling, weighing about fifty-four tons each, have been broken right through on the south side, and the chamber actually holds together only by the force of sticking and thrusting; its eventual downfall is, as Mr. Petrie says, "a mere question of time and earthquakes." As one of these cracks and many of the joints have been daubed up with mortar, it seems that the injury must have occurred before the pyramid was finished. The sarcophagus, in which great interest was centered by Professor Piazzi Smyth's theory, as it was supposed to exhibit a standard for all the Pyramid dimensions, is found by Mr. Petrie to be rather a careless piece of work. Marks of the saw which still remains show that the masons have more than once cut deeper than they intended, and have even tried to polish away their mistakes, but without wholly succeeding. The coffer was raised to see if there were any marks underneath it to indicate that it stood in its original place; but no such marks were found. Mr. Petrie gives some interesting details relative to the change that took place in the workmanship of the Pyramid in the course of building. The site was levelled with great care, and the base laid out with wonderful exactitude. The basalt pavement on the east side of the Pyramid and the limestone pavement on the other sides are splendid pieces of work, the blocks of basalt being all sawn and fitted together with the greatest accuracy.

The lower part of the casing, of which Mr. Petrie for the first time uncovered some blocks *in situ*, is exquisitely wrought, and so is the Entrance Passage; "the means employed for casing and cementing the blocks of soft limestone, weighing a dozen to twenty tons each, with such hair-like joints, are almost inconceivable at present, and the accuracy of the levelling is marvellous." But the same excellence is not shown in the upper parts of the building; the upper part of the Great Gallery is much askew; in the antechamber, bad stone has been employed, and its defects rudely plastered over; and in the King's Chamber, though it is composed entirely of magnificent granite blocks of admirable workmanship, there is an error in the levelling, causing a difference of two and a quarter inches between the courses on the north-east and the south-west, an error which, if not due to natural causes, is surprising in such a piece of work as the Great Pyramid. In many places the stone has been left in the rough, to be dressed down when it was put in position, but which has been left undressed. Mr. Petrie suggests that the architect of the first period of the building died in the midst of his work, and was succeeded by one who exercised less careful supervision, and that thus the building was somewhat hastily finished. As the roofing-beams for the King's Chamber are all numbered, and marked for the north or south sides, Mr. Petrie thinks it probable that they were all hewn in the lifetime of the first architect, and fitted into position outside the Pyramid, but were built into their place by the second and less careful architect.—*Chamber's Journal.*

Famous Paper.

The paper used for printing the Bank of England notes has always been made by the Porter family, whose ancestor came over from Bordeaux after the revocation of the Edict of Nantes, bringing with them the art of making fine paper, which, like those of silk weaving and dyeing scarlet, was, up to that time, unknown in England. Except by burglary, it is absolutely impossible to obtain a scrap of the beautifully water-marked paper produced at the mill at Laverstroke. Every piece of this paper is registered before it is removed from the frame, an account is kept by a locked dial, and every damaged note is accounted for, being ground up again into pulp. This paper—it is, perhaps needless to tell any one—is quite unique. Tested by touch, it emits a crisp, crackling, sharp sound, and in color it has been described as "neither blue wove nor cream laid, but white of a hue that can be compared with no other white." The three deckeled edges show the natural boundary of the pulp when first moulded. The fourth is left smooth by the knife which cuts the notes in twain. The paper is tough—so tough, indeed, that after the addition of one grain of size it will hold a weight of sixty pounds without tearing. Yet the quantity of fibre in a £5 note is not more than eighteen and a-half grains, and the sheet is so thin that erasures are oftimes found to be extremely difficult.

But what constitutes the main safeguard of the bank is the "water," or, more properly, the wire "mark," that transparent design which can be instantly detected when the paper is held up between the eye and the light. This device is obtained, as all water marks are, by twisting wires to the desired shape and sticking them on the face of the mould, so that when the pulp settles down it must of necessity be thinner on the wire design than on the other parts of the sheet. The water is then permitted to run through the seive like face of the mould, and the sheet of paper in embryo "couched" by the mould, being gently but firmly pressed upon a blanket to which this spongy sheet clings. Sizing is a subsequent process, so that when the dry water mark is plainly seen, being transparent where the substance is driest. This water mark is secured to the bank by virtue of a special act of parliament, so that, apart from the pains and penalties which attach to any attempt to circulate forged notes, it is a very risky game to imitate even the trade mark of this most important monetary institution in the world.

The Largest City in the World.

The annual accounts of the Chamberlain of the City of London were issued in a parliamentary paper recently. On coal and wine the duties received amounted to £385,987, the expenses of management came to £4,322, and the balance had been paid to the account of the "Thames Embankment and Metropolis Improvement Fund." The Blackfriars Bridge account shows receipts to the amount of £5,442 and a balance on the expenditure of the year to the extent of £1,251. On police account the receipts were £104,298, and the expenditure £103,278, leaving a balance of £1,020. The Police Superannuation Fund amounted to £10,008, the whole of which was absorbed. The ward rates produced £7,098, and the expenditure left a balance in hand of £789. The receipts on account of sewers (consolidated rate account) was £1,069,701, and there was a balance in hand of £85,738. In the sewers rate account the receipts were £19.767, and the expenditure £8,657, leaving a balance of £11,110. On the Metropolitan Board of Works sewers rate account the receipts were £109,746 and the expenditures £84,696, leaving a balance of £25,049. The Coal Market fund showed receipts £3,514 and expenditure £2,413. A very important statement is the city's "duty on coals." This amounts in the whole to £167,374, and shows a balance transferred to surplus account of £85,678. The surplus account, which is set forth separately, showed a total of £91,644 available for the discharge of loans, and of this £60,000 was absorbed in the discharge of loans respecting the Holborn Valley improvement and £28,000 by transfer to moneys due to bondholders' account, leaving a balance of £3,644. The Clerkenwell Improvement Fund showed receipts to the extent of £8,059, which was all expended, chiefly in repayment of moneys advanced. The City of London grain duty yielded a sum of £39,800, and this was chiefly devoted to the purchase and maintenance of open spaces. Epping Forest figures as absorbing £15,736, St. Paul's Churchyard £358, Burnham Beeches £861, and Coulsdon and other Surrey Commons £286. The dwelling-House Improvement Fund showed a balance overdrawn of £80,650, while credit was taken for the erection of artisans' dwellings on the Petticoat Square site costing £42,500.

Electric Railways.

The Boston *Advertiser* thus summarizes the workings of the electric railways in Baltimore and Cleveland:

Electric motors for street railways are proving successful in Baltimore and Cleveland. The systems are different. The one in Baltimore has a central rail, insulated from the ground, but thus far exposed on the surface. Dogs and horses are occasionally shocked by it. There is talk of enclosing it. The motors used are the Morse and Faraday. One weighs about 4,500 pounds, and will haul a full horse-car four miles in twenty-five minutes, most of the way up-hill, and some of it steep. The dynamos, of which there are two, are driven by a 35 horse-power engine. Each dynamo is of 50 horse power, and one suffices for ordinary traffic. The Bentley Knight railway in Cleveland differs from this in the respect that the electricity is conducted from the dynamo by a stationary cable in a conduit under the track, and through an opening in the top an electric brush reaches down from each car, taking up the electricity to a small motor under the car, from which bands run to pulleys on the axles. The inventors make the following estimates for five miles of double track and the operation of forty cars.

Estimate for Newly-constructed-lines.

Cost of horse road	$162,000.00
Cost of electric road	344,100.00
Cost of cable road	414,750.00

Annual Expense of Motive Power for

Horse road	$102,960.00
Electric road	30,551.50
Cable road	75,500.00

Annual Saving in Cost of Motive Power.

Electricity over horses	$72,408.50
Electricity over cables	45,038.50

BETHLEHEM IRON CO. TO MAKE ORDNANCE.—It is surmised that the Bethlehem Iron Company, in order to retrieve losses sustained during general depression of business throughout the country, are making preparations to get their plant in readiness to furnish whatever ordnance is needed by the Government. The preparations are going on irrespective of Government aid. The Bethlehem Iron Company are the first in the field, and when the $13,000,000 appropriated for ordnance is passed by Congress there can be no doubt that the Government can safely and wisely intrust contracts to parties who at their own expense have made preparations to manufacture ordnance. Certain it is that $13,000,000 should not be allowed to fall into the hands of political jobbers and speculators. It is circulated and generally believed that Superintendent John Fritz's trip to Europe has something to do with the preparations mentioned above.—*Bethlehem Times.*

Tall Chimney Construction.[1]—IV.

THE GEORGS—MARIEN IRON-WORKS, NEAR OSNABRUCK.

The first chimney, erected in 1857, has a height of 180 feet.

	ft.	in
Clear width at the bottom	10	0
" " top	7	0
Height of square basement built in sandstone	30	0

Octagonal shaft of brick; the walls of which are made of six different thicknesses, consisting of one and one-half bricks at the top, and of four bricks at the bottom. (The length of the bricks used at Georgs-Marienhutte is ten inches.)

Two other chimneys, one hundred and two feet high, have also a square basement of sandstone, and an octagonal shaft of bricks, with a clear width of four feet at the top, and of six feet three inches at the bottom; the walls of these shafts are each twenty inches thick at the top, and thirty inches thick at the bottom.

A fourth chimney erected in 1868 has a height of one hundred and two feet, a clear width of seven feet at the top, and nine feet at the bottom; the shaft is built of four thicknesses of one, one and one half, two, two and one half bricks, while the base, eighteen feet in height, and made of sandstone, is three feet six inches thick. The shaft of this chimney is built from the base to the top in such a manner that it forms in the circumference four separate parts, which are simply brought in contact with each other without being jointed by mortar.

This construction has been found to answer exceedingly well, and is recommended for chimneys exposed to various temperature, as for example, in the case of chimneys connected with coke ovens; the gases of which are either applied to the firing of boilers, or are allowed to escape directly into the chimney, in the event of the boilers being laid off for cleaning or repairs. The latter arrangements have, however, been altered so far that, with the hot gases, cold air is simultaneously admitted into the chimney.

The most recently erected chimney, built in 1870, is sufficient for twenty of the Cornish boilers, and has a height of one hundred and twenty feet, and a circular shaft of a clear diameter of ten feet at the top, and ten feet ten inches at the bottom. This chimney has no base, and the thickness of the walls decreases in seven steps from four bricks to one brick (ten in each.) The circular form has been chosen in order to save the expensive base, and the many shaped bricks necessary for octagonal chimneys. All the chimneys have been erected with scaffolds, and by conveying the materials throughout the inner space of the chimney: and neither at the erection, nor during their use has any fault been found.

Grosvenor-road, Pimlico, Pumping-station (Western District Main-drainage Works).

This chimney-shaft of gault bricks and Portland stone dressings, is two hundred feet high, and has quite a campanile-like appearance, with its recessed and arcaded sides. It is a model shaft in its style. The foundations of the shaft rest upon a mass of concrete thirty-five feet square, carried down to the clay.

The shaft is constructed double.

The circular central shaft is seven feet diameter, serves for the smoke, while the outer square casing encloses a staircase consisting of two hundred and twenty stone steps, reaching to the top, which is terminated by a heavy iron capping and stone cornice. It will be thus seen there is some æsthetic reason for the Italian tower-like casing. This square tower measures twenty-one feet at the base, and fifteen feet at the summit.

[1] A paper by R. M. Bancroft and F. J. Bancroft, read before the Civil and Mechanical Engineer's Society. Reprinted from *American Architect*.

Sir J. Bazalgette, C. B., engineer-in-chief; Mr. Lovick, resident engineer.

The bricks were purposely made, and gradually tapered from eighteen inches to fourteen inches.

The lightning conductor is of copper tube.

Chimneys at Den's Works, Dundee.—No. 1.

This chimney is—
193 feet from bottom of foundation to point at top.
174 " " ground level.
9¼ square feet inside at base = 90.25 square feet area.
6 " " " top = 36 " " "
Contracted at outlet to 25 " " "

It carries away the smoke from:

Fifteen boilers sixty-three feet below base of chimneys = two hundred and twenty-five feet from firing level to point at top. The smoke is conveyed from both of these ranges of boilers to the chimney by a long sloping brick flue or tunnel. Cases sometimes occur where it is necessary to have the chimneys some distance from the fires, Mr. Clegg, in his treatise on the "*Manufacture of Coal Gas*," page 177, says:—At Dolphinholme, in Lancanshire, where a large worsted mill was lighted with gas, it was necessary to remove the chimney a quarter of a mile; the flue to same being carried along a field arising about one in twenty.

Four boilers eighty-six feet below base of chimney = two hundred and forty eight feet from firing level to point at top.

Total, nineteen.

The range of four boilers (each having two flues), consume eleven tons each, or about forty-five tons of coal per week of sixty hours work, or fifteen hundred-weight per hour, and the opening at the bridges of these boilers is one hundred and twenty-three inches .·. four boilers by two flues = 8 x 123 inches = nine hundred and eighty-four square inches at opening.

$$\frac{\text{984 sq. in. at openings}}{\text{15 cwt. consumed per hour.}} = \text{65 sq.in.for 1 cwt. per hour.}$$

Mr. Carmichael records having made ninety observation on the draught at the bottom of the chimney.

The highest recorded..... .88
" average " 8
" lowest " ..... .55

In taking the observations, the height of the barometer was noted and the direction of the wind. The changes of the barometer do not show (Mr. Carmichael says) much effect on the force of the draught; it seems most affected by wind, being lowest in a south or south-west wind.

No. 2.—This chimney is—

135 feet from ground level to point at top.
7 " sq. inside at base = 49 sq. ft. area = 7 sq. ft. for each boiler.
4¼ sq. ft. inside at base = 18.06 ft. area
Contracted at outlet to 13.78 " " = 190 sq. ft. for each boiler.

It carries away the smoke from seven boilers, the furnaces being about level with base of stack. They consume about seventy-five tons of coal per week of sixty hours' work, or twenty-five hundred-weight per hour from getting up steam on Monday until stopping on Saturday. The opening at the bridges is one hundred and twenty-three square inches ··· seven boilers by two flues = 14 x 123 = 1,722 square inches at openings,

$$\frac{\text{1,722 sq. in. at openings.}}{\text{25 cwt.consumed per hour.}} = \text{6859 in for 1 cwt.per hour.}$$

When Mr. Carmichael wrote of this chimney, he had made ninety-four observations on its draught.

The highest recorded..... .875
" average " ..... .75
" lowest " ..... 6.

This chimney was built for four boilers, and while so working it collected soot inside to a considerable extent; and occasionally the soot caught fire, and burned out in sparks and showers of smut. When working with the seven, as above stated, it became free from soot, and the surface of the bricks perfectly clean.

No. 3.—This stack being intended to supply only a few boilers, it was made as small and light as possible.

102 ft. 8 in. from ground level to point at top.
4.25 sq. ft. inside at base=18.06 sq. ft. area.
1.5 " " " top = 2.25 " "
Contracted at outlet to 1.75 " "

When first built, one boiler only was connected to this chimney, the consumption of coal being about ten tons per week.

Of the thirty-one observations recorded

The highest was..... 537
" average..... 5
" lowest..... 45

Some pigeon-holes, sloping accurately upwards, were made in each side at the top, thinking, the wind blowing into these, the current being thus directed, it would assist the rising smoke. The effect produced was, that that the smoke issuing from them blackened the top a greater distance down the chimney.

Mr. Carmichael says the chimney appears to be too large for one boiler. A coating of soot formed on the inside from three-fourths to one-and-one-half inches thick, and he draws this inference; that when a chimney is too wide, the heated air is expanded and cooled down, so as to have a sluggish motion favorable to the deposition of soot.

There was a violent storm of wind at Dundee on Saturday, the 13th of February, 1864, which is taken notice of here, because it gave an opportunity of making some observations on the chimneys. At the height of the gale, which fortunately was between two and three o'clock in the afternoon, when most of the work people had gone home, the tops of both chimneys, Nos. 1 and 2, were blown down at the same instant, making almost a simultaneous crash in falling, all the taper top being carried away in both cases, without injury to the square shafts of the chimneys.

The gale was more violent than has been experienced for at least twenty years, as was evident from its blowing down the top of No. 2, which had stood from 1844, and also by the destruction of other chimneys and buildings in the district. Being present at the time, I was anxious to see how the chimneys behaved in such violent storms, and this was seen to some extent by looking as No. 1 in line with the corner of a high mill, keeping the head steady. The movement was plainly visible; not a swaying motion like a tree bent by a blast, and recovering itself during the lull, but a steady rocking motion like the swing of a pendulum. The oscillation did not appear to exceed twelve inches, and the observations gave a feeling of security as to the stability of the chimney.

The tops of these chimneys were not rebuilt for some months, having to wait until the fires were out for a few days at the annual holidays. In rebuilding, the bricks were made to models in much heavier pieces than before and dovetailed together.

While the tops were off there was not much difference in the draught, the cross door at top not being injured; but there was more dark smoke than before or after, and it did not rise so freely, but in a breeze of wind, fell down the leeward side, and clung more to the chimney.

When the tackle was up for getting to the top of No. 2 chimney, the opportunity was taken to make some observations on the heat of the escaping products, and also to see how much the outlet at the top could be contracted without injuring the draught.

With a view to this, the draught was tested for several days with the water-gauge, and it showed fully 8. and at the same time the heat of flues were tested; at bottom of chimney 500° melted in one minute, 600 melted in longer or shorter time, depending upon the state of the fires.

Expecting that the temperature would be much lower at the top of the chimney, the operator was supplied with the alloys melting at 212°, 286° and 367°. These melted very quickly. Then 440° and 500° were tried, when both melted in a little more than two minutes; 600° would not melt, thus showing the temperature of the escaping products at the top of the chimney to be between 500° and 600.°

A sheet of iron was then put on the top of the chimney contracting the outlet two and three fourths square feet. This was tried for two days, and did not affect sensibly either the draught or the temperature.

The outlet was then contracted still further by a larger sheet covering 5.84 square feet. This had a perceptible effect on the draught.

The experiments were not carried farther, there being considerable difficulty and some danger in following them. By contracting the outlet with a proper taper instead of merely laying on a flat plate, the contraction might have been carried still farther.

Mortars.

Extensive experiments have been carried out with mortars in America during the past year, those used being converted from two 10-inch, Rodman smooth-bore guns. The dimensions when cut down were as follows: Length of chamber, 7.5 inch; length of bore, 82.5 inch; length of the rifled part of the bore. 72.5 inch. No. 1 mortar contained 30 lands and 30 grooves, .075 inch deep, of right-handed twist, increasing from one turn in 100 calibres at the breech to one turn in 35 calibres at 1 inch from the muzzle. No. 2 mortar had 40 lands and 40 grooves .04 inch deep, of right-handed twist, increasing from one turn in 45 45 calibres at the breech to 1 in 25 at 1 inch from muzzle. An extempore carriage was used, which militated against the accuracy of the firing, as it was not firm enough. The trials were made in order to discover the most suitable charges, density of these charges. ranges and accuracy at various elevations, and to compare three different types of rotating bands, and the rifling of the two mortars. After a very exhaustive course of experiments it was concluded that No. 1 mortar was superior to No. 2. With reference to the charges, etc., the following results of rounds fired from No. 1 mortar may be interesting; the weight of the projectiles was in all cases 350 lb. about,

Charge.	Density.	Elevation.	Range.	Time of Flight.	Pressure on Square Inch.	Dispersion.		Remarks.
						Direction.	Range.	
lb		dg m	yds.	sec.	lb.	yds.	yds.	The dispersion in range is the difference between the max and min. ranges and the dispersion in direction is the difference between the max and min. durations.
15	1.6 66. 8. c. i. per lb.	60.0	3278	37	11 000	24	339	
5	1.6 40. 1. c. i. per lb.	28.36	5700	26½	29 090	24	339	
30	1.7 83. 4. c. i. per lb.	28.36	3380	32¼	15 500	128	2220*	

*A mean of three rounds.

It will be observed that the firing with 30 pounds of powder was very erratic, there being a difference of 2220 yards between the maximum and minimum ranges in eight rounds.

GENERAL GRANT AS AN ENGINEER.—It is not generally known that in 1859 Gen. Grant, then a comparatively obscure civilian, applied for the position of County Engineer of St. Louis County, Mo. The position was worth $35 per week; but he was unsuccessful, one C. E. Soloman beating him in the vote. Grant's letter to the County Commissioners is still in existence and has been lately reproduced in facsimile by some of the daily papers.

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OUR proof-reader's summer vacation is responsible for some rather awkward errors in last issue. While we recognize the utility of a "brass bridge," for instance, from a non-corrosive standpoint, we have yet to learn of the practical application of this metal in that direction. The rather bad manuscript read "truss bridge."

THE Waterways Convention, recently in session in St. Paul, Minn., has been chiefly of interest to the residents of the Mississippi Valley, judging from the general results arrived at. The main points presented, as requiring the expenditure of some portion of the "national surplus," were: the extension of the reservoir system on the upper Mississippi, the building of the Hennepin canal, the general improvement of the Mississippi and Missouri rivers, and, though somewhat out of that district, the construction of a ship canal across Florida. The convention recommended the annual appropriation of $25,000,000 for "river and harbor improvement."

We heartily approve of the expenditure of public money for the public benefit; and the sum named is none too much, if it is properly applied. But some of the improvements suggested, the regulating of the Missouri, for instance, can in themselves soon swallow up the whole of our surplus. Excepting the work at one or two points, we believe that all efforts to bridle that erratic stream have so far failed. As to the distribution of the money to be annually expended in river and harbor improvement, we doubt not that the old rule will hold good for the future; each congressman will secure for his district all that he can get, no matter how it is to be spent.

The Deacon Waste Water Meter.

In our issue of May 2nd., we published an article on the use of the Deacon meter in Frankfort-on-the-Main, by W. H. Lindley, M. Inst. C. E., and Chief Engineer of that city. We are now indebted to the courtesy of Samuel A. Strang, Esq., the sole representative of the meter in the United States, for a further communication from Mr. Lindley on this subject so very important to our own consumers of water.

Mr. Lindley, under date of July 11th., says that the results obtained from the introduction of the Deacon meter into two of the water districts of Frankfort "have not only fully come up to our expectations, but have even surpassed them." It was specially found that the percentage of loss in the pipes for public use was considerably greater than was supposed, from the trial in the two experimental districts named; and upon the extension of the system, these losses were quickly detected, located and repaired. In several districts this loss is already reduced to zero, and broken pipes long in existence have been repaired, the leakage from which amounted to from 1 to 25 cubic metres per hour, "and even more in some cases."

In the districts where greatest waste existed, and accordingly the greatest attention paid to improvement, the loss was reduced from 50 to 100 liters per head per day, that is, 13 to 26 gallons. In some districts the total consumption was reduced from 250 liters to 80 and 60 liters per head per day,—from 65 gallons to 21 and 16 gallons.

In several districts in the inner town the waste water meter detected cases of willful waste where water-taxes amounted to only 2, 3, 4 and 5 per cent. of the amount properly chargeable to the consumers. About 5,842 leaks, valves, etc., were repaired, of which one-third were screw valves, the rest miscellaneous. While during the previous winter the high service reservoirs were seldom filled to overflowing, after the introduction of the system, this was a constant occurrence, notwithstanding the fact that the supply from springs was less than usual.

"It can be truthfully said that *leakages amounting to 5,000 cubic metres* (1,321,000 gallons) *were done away with*;" and further, that while last summer the water supply had to be stopped during 13 hours daily, now the system of pipes is under pressure all day, with a slight reduction of pressure in the branch pipes for a few hours about midnight; and this is in the face of a reduction, over last year, of 1000 cubic metres per day in the pumpage.

While the above exhibit, as made by Mr. Lindley, must be highly gratifying to himself and the city authorities, the results have been almost equalled in our own city of Boston, the only American city which has had the wisdom to fairly test the merits of a system so favorably known abroad. Why this is so, is one of those questions that "no fellow can answer," all engineers connected with American water distribution uniting in the conviction that an immense proportion of the water pumped is wasted and not legitimately consumed. But with this knowledge and the further knowledge that means have been successfully applied within our own bounds to stop this waste, our cities are slow to adopt the necessary measures. The theory, that Americans require and habitually use, more water per head than the residents of foreign cities, is based rather on the assumed consumption than on facts, and a few well directed tests, as in Boston, will soon prove this to be true, to the financial benefit of cities now appropriating vast sums for the extension of existing works.

In Liverpool, it is assumed by good authority, that the saving by the waste water meter for a number of years past has amounted to the capital now being invested in a new aqueduct; or about $200,000 per annum, and that that work has been just so long postponed. In London, the private water companies have testified that but for its use they would have been compelled to increase the water rates. Vienna, Bombay and Yokohama are now introducing the system.

Sir Frederick Bramwell, President of the Institution of Civil Engineers, and one of the very highest authorities on this subject, in his late address to the Institution, quotes the results as reached in Liverpool as typical of the most advanced practice, and thanks Mr. Deacon by name for making it possible to deal with water distribution at a minimum of cost and annoyance to the consumer.

In Boston, Mass., according to the report of the Water Board for 1884, the cost to the city of each 100 gallons of water furnished is computed at 1.25 cents, and on this basis the reduction in consumption by the use of the Deacon meter represents, in round numbers, the sum of $1,200 per day during the first eight months of 1884. And it is worthy of especial note, in connection with the legitimate demand for water, that in the months of July and August during this period, the consumption per head per day was only 34 to 36 gallons. The saving in coal at the Highlands pumping station alone was 35 per cent., for these eight months, over the previous year. The reduction brought about by this means presented in cold figures, is shown in a tabular statement made by Mr. Dexter Brackett in the same report, we summarise as follows: In July, 1883, the "consumption" per head per day was 102.4 gallons, in the same month 1884, with the Deacon meter in operation, it was 68.9 gallons; in August, 1883, it was 103.2 gallons, in August, 1884, it was 67.7 gallons. The percentage of reduction for these two months was 32.7 and 34.4 respectively, or a saving per day in the supply of 11,366,000 and 12,075,000 gallons. This percentage of reduction ranges through all the months from January, the lowest being 10 per cent.

With these cold facts before them and the actual saving of money so far surpassing the comparatively trivial outlay required to practically test the system, it does seem passing strange that more of the cities now crying for an added supply do not first attempt to economize in the use of the supply they already have. We would imagine that self-interest and plain common sense would drive the controlling authorities to the trial at least. Under the present conditions of rapid increase in population and distribution districts it is certainly more sensible to do all that we can to check and prevent the *waste* of water rather than to exhaust our resources, and treasury as well, in the attempt to encourage still further waste by an additional and too often unnecessary supply. Water is like any other commodity of daily use; it must be paid for by some one, and if we supply each head of a large population with 100 gallons per day, when 60 gallons, or even 36 gallons, will meet all proper demands, the difference represents just that much absolute loss of capital.

Street Paving in Philadelphia.

John D. Estabrook, Chief Commissioner of Highways of Philadelphia, in his last annual report, indulges in some very plain talk concerning the methods usual in the street improvement of that city; a talk that is as refreshing in its character as it is unusual in its bluntness, coming as it does from a city official.

To understand the purport of his attack upon prevailing customs, it is necessary that the outsider should first have some knowledge of the conditions under which street paving is done in Philadelphia, and the Chief Commissioner gives these conditions about as follows:

The cost of the first paving of the cartway of any street, including its maintenance for the first 3 or 5 years, is assessed against the

property abutting upon it. The city then assumes the care of the street and the cost of any different pavement that may be subsequently laid; and the city also pays the first cost of paving street intersections.

Until within a few years all street paving was done with Delaware cobble stones or rough rubble stone. The practice with paving contractors in former times, was to solicit signatures of the majority of the property owners on a street they wish to pave, requesting them to do the paving; and these signatures secured, they were entitled to the contract at the uniform paving price fixed from year to year by Councils.

Later, it was required that all paving should be advertised and let to the lowest bidder; and still later, cobble and rubble pavements were, by ordinance, prohibited. The practice of paying for the paving of streets, not in cash, but in assessments on abutting property, is still general.

In this last named feature lies the chief trouble to which the Commissioner refers. It gives rise to all manner of trading between the contractor and citizens, with extension of time, discounts, etc. This is discreditable to the city; and, as Mr. Estabrook says, the city should pay for its contract work in cash and collect the assessments from the property holders itself. Under the present system, owners can pave private streets at their own expense, sell the abutting property, and as the sale of the property virtually dedicates the street so far as that property is concerned, the city inherits the pavement, most frequently very inferior in quality, and must maintain it.

Mr. Estabrook certainly has the courage of his convictions, and in his report condemns a practice that while long recognized as a feature in the political "ways and means" of practically all cities, has seldom been referred to in an official report. And this is the open assessment of the department having public work in charge, from one to two thousand dollars for political expenses at each election, and requiring the officials of such a department to make collections for political purposes from contractors and employés. As Mr. Estabrook well remarks, such practices lead to fraud and accusations of fraud, and can not be too severely censured, nor too soon abolished. In speaking of the future pavement of Philadelphia, for the paving of that city is still in the future, the Commissioner refers to the experts' report of 1884, showing that then 93 per cent. of the 9,793,469 square yards of paved streets were cobble stone and rubble, with 6⅔ per cent. granite block and ⅓ of 1 per cent. asphalt. The experts recommended 7,000,000 square yards of granite block, and 1,400,000 square yards of asphalt pavement, to cost about $21,000,000.

The Commissioner raps the City Councils over the knuckles for charging him, one year ago, with intending "to pave the whole city in one year" when he asked for a paving appropriation of $500,000; and, in 1885, reducing his estimate for this purpose from $400,000 to $50,000. As paving a 50 feet street, with a cartway 26 feet wide, costs about $7.60 per linear foot, or about $40,000 per mile, an appropriation of $50,000 is just sufficient to pave 1¼ miles per annum. With 570 miles to pave, "it can be readily seen that the great-great-grandchildren of the present generation will have been centuries in their graves before the work can be completed."

Electricity Applied to a Calculating Machine.

Calculating machines have been a favorite study with mathematicians and mechanical experts for nearly three centuries, though the abacus dates back to the days of Solon and beyond. The machine of Blaise Pascal (1650) finds its modern prototype in the registering device on gas meters, but the one commenced by Babbage is perhaps the best known and most elaborate. On this yet unfinished piece of intricate mechanism the renowned inventor spent 12 years of time (1821-1833) and the British government a sum of about $75,000. Babbage called his machine a *Difference Engine*; it is a mass of cogged gearing, dials, etc., and so complicated that the skilfull Dr. Lardner occupies 25 pages of the Edinburgh *Review* in partially explaining its complex action. It was never finished, the difficulty lying in effecting the necessary change in digits in high numbers by means of gears.

But this is the day of electricity, and it has been reserved for a veritable Yankee, a Mr. Chas. F. Pidgin, Chief Clerk of the Mass. State Bureau of Statistics, to substitute for complicated and endless gearing, this quick moving and frictionless agent. The inventor started to make an instrument on which every step in addition would be performed mechanically without any puzzling side-rules, and he seems to have succeeded perfectly. One movement brings any single digit from 1 to 9 into its proper place; the instrument carries automatically, and any digit may be added to a number already down by two motions of the hand. The power of the electrical battery and the size of the machine alone limits its capacity, and its speed is from two to six times that of the most expert accountant. Anyone can learn to operate it in a few minutes.

The record is shown on dials somewhat in the same manner as on the street-car conductors, register, except instead of making nine motions to register 9 units, one movement only is required, and the movement of the dials is effected by electricity instead of by cogs. The perfection of the device is such that on the machine in the census office, which has nine dials, the addition of one unit to the registered number 999,999,999 sets all the dials at zero, so that if there was another dial the record would be 1,000,000,000.

The mechanism is enclosed in a box 2 feet long, 1 foot high and 8 inches deep; in front of this box are two plates, 20 × 8 inches, one horizontal, the other vertical. Across the vertical plate is a horizontal row of circular openings, behind each of which is a dial on which the numerals from 1 to 9 appear consecutively as the dial is turned. Crossing the horizontal plate are a number of rods, one for each dial, on which rods keys can be moved backward or forward by the hand. Against each rod are the numerals from 0 to 9 ranging from front to back, and by moving the keys along the rods electrical impulses are given which turn the dials, by means of apparatus inside the box.

In operating the device, by sliding the key from the front to the numeral 1, for example, the corresponding dial moves so as to expose the next higher numeral; but if the key is pushed to 9, the dial receives 9 electrical impulses and that number is recorded with the accumulated 10, if required, shown on the next dial. In adding, figures are divided into tens, hundreds, etc., and each set is manipulated on its corresponding rod and dial; so to add 123 to 456, for instance, the operation would resolve itself into the separate additions of,—3, 20, 100, 6, 50, 400, each worked on its appropriate rod. The result, 579, is shown on the dial as soon as the last movement is made.

As multiplication is also practically the addition of certain numbers, Mr. Pidgin has discovered a simple formula by which any number may be multiplied on his machine; and he has also invented a method of using a "percentage chart" in connection with the calculator, in such manner, that the percentage of any number from 1 to 1,000,000,000, of any other number from 1 to 1,000,000,000 may be obtained by the simple addition of two or three numbers, with the decimal carried to the seventh place, and without writing down anything but the answer. This machine is in practical use in the Massachusetts census office, in Boston, and a company is now being formed to introduce the labor-saving device into public offices, banks, etc.

The Lick Observatory.

The last number of *Science* contains a very complete record of progress on the Lick Observatory, illustrated by photographic views.

James Lick was born in Lebanon County, Penna., in 1796, went to South America at the age of 35, and accumulated a fortune of about $45,000, which he invested in real estate in San Francisco in 1847, to his great profit. He died in 1876, and among his scientific bequests was the sum of $700,000 to be expended in the erection of a great observatory on a mountain elevation

He first suggested Lake Tahoe, 8,000 feet above the sea; but in 1876, upon the advice of Mr. Thos. E. Frazer, decided upon Mount Hamilton as a proper site. Mount Hamilton is on the Pacific coast range, about 50 miles southeast of San Francisco, and 13 miles from San Jose, the nearest city. A telephone line and an excellent mountain road, connect the mountain with San Jose. The summit is triple-pointed, and is about 4,500 feet high, with no equal elevation within a radiu of 100 miles. The most southern of the three peaks was selected for the observatory; it is bare of woody growth, is most accessible, and has the minimum of obstruction to the South, East and West.

In cutting down this apex for the reception of the building, 45,000 tons of rock were removed, leaving an irregular oval plateau 450 by 250 feet. The site is surrounded by a government reservation of 1,500 acres of land.

In the autumn of 1879, Mr. Sherbourne was invited by the Lick trustees to test and study the atmospheric conditions for observational research. From August 17, to October 16, inclusive, he found: first-class nights, 42; medium nights, 7; cloudy and foggy nights, 11. The architect's plans for construction were decided upon in the spring of 1880, under the advice and supervision of Capt. Floyd, Mr. T. F. Frazer, Supt. of Construction, and Professors Newcomb and Hadden; work was at once commenced.

In the autumn of 1881, the transit of Mercury was observed with the 12 inch equatorial and the 4 inch meridian transit instrument, in their permanent quarters, with a complete series of satisfactory observations. During 1882, work on the main building was continued, and a permanent water supply secured from springs 409 feet below the summit, and two reservoirs of 85,000 and 70,000 gallons each were built. In 1882, the transit of Venus was observed, and excellent photographs obtained by the photoheliograph then added; the total eclipse of March 16, 1885, was also photographed.

The plan of the main observatory building includes a long, one-story edifice, running north and south, with the entrance, and secretary and visitor's room in the centre; a library and director's room to the south, and terminates in that direction with the 36-inch equatorial room. To the north are, a dormitory, shop, clock room, and the 12-inch equatorial. A separate building contains the 4-inch transit instrument, and the 6-inch meridian circle; and another still has in it the photoheliograph.

Among the principal instruments of the observatory is the Repsold meridian circle Its object-glasses are 6½ inches in diameter, made by the Clarks. The building sheltering this instrument is 43 by 45 feet, with double walls, the interior of wood, the exterior of iron with abundant space between. In addition to the circle, the following instruments are in place: A 4-inch transit instrument, by Fauth; a 4-inch comet-seeker, by Clark; a measuring-engine, by Stackpole, reading either rectangu-

lar or polar co-ordinates; five clocks, by Dent, Frodsham, Hohwü and Howard, and four chronometers by Negus; a 6½ inch equatorial telescope; a 2-inch Repsold vertical circle, and a complete system of electric connections, workshop with complete outfit of lathes and tools, and an astronomical library costing $5,000.

The work remaining to be done is,—the making of the object-glasses of the great telescope, the construction of the mountings of this instrument and the building of the enormous dome to hold it. The contract for the object-glass—one-half of the total cost of the instrument—was placed with the Messrs. Clark nearly 5 years ago. Two years later they received from Feil of Paris the disk of flint glass required, 38 inches in diameter; this is now waiting for its companion disk of crown-glass before work can be attempted upon them. These disks must be first carefully tested before the proper curvatures can be determined. Fifteen or twenty moulds of the crown-glass have already been ruined in the attempt to get them into the required disk-form. It is hoped that all work can be pushed so that the great telescope may be completed in 1887. When finished, the trustees will transfer the establishment to the University of California, which will afterwards control it.

In speculating upon the possibilities of astronomical research by aid of this great telescope, it is not unreasonable to suppose that, when directed to the moon in so favorable an atmosphere, a few nights at least in the year can be found when the maximum magnifying power of the lenses can be brought into play. This power will be 3,500 diameters and would reduce the theoretical distance to the moon to about 60 miles. Making due allowance for the effects of the earth's atmosphere and other unfavorable considerations, the observer might expect to see the moon as if it were only 100 miles away, under the most favorable conditions of illumination by the sun and minimum distance from the earth—220,000 miles—it is possible that the details of its nature might be satisfactorily made out even though they are not larger than some of the larger edifices on the earth.

The Water Supply of Amsterdam.

We extract from a lengthy paper, by M. Ed. Couche in the *Annales des Ponts et Chaussées* for July, 1885, the following description of the water supply of Amsterdam:

The peculiarities of the situation are, that Amsterdam has no available pure water sources in its neighborhood, and the river water is not potable, and in addition, there is no elevation upon which a distributing reservoir can be located. These are features common to almost the whole of Holland, and the system of supply adopted in Amsterdam is reproduced with slight variation in the chief towns of that country.

Amsterdam, to procure potable water, must extract from the sand dunes of Haarlem, by a long canal, the rain water falling upon them. The drainage canal is about 11 miles long; its greatest depth is 13 feet, and at the bottom it is about 50 feet wide. This great section was adopted to reduce the velocity of flow and prevent the carriage of solid matter.

In despite of this precaution and the feeble supply from the canal, which is generally from 18 to 20,000 cubic metres per 24 hours, the water reaches the city in a muddy state and requires filtering. This operation is conducted as in London, except that as the water is never so charged with solids as the Thames, at times, settling basins are omitted. The works, which include these filters and the pumping plant, are located about 3 miles south of Haarlem.

The water leaves the canal, coming from the dunes, by a subterranean conduit, in which gates control the quantity passing into the filter-beds. There are five of these beds, having in all about 14,000 square metres of area, and generally three of them are in service and two are being cleaned; this cleaning taking place once in 10 days for each bed.

But the peculiar feature in this Holland water supply is the continuous distribution of water under pressure by means of a water tower, without any reservoir intervening. The tower near Haarlem, is about 14 miles from Amsterdam, and it has two discharge mains leading from it, of 17 and 20 inches diameter respectively. The water tower is simply a large vertical pipe surmounted by a small reservoir and supported by a metallic frame-work, about 170 feet high to the base of the reservoir.

Ordinarily, the water does not reach the reservoir on top, its chief use seems to be for the prevention of overflow in case the pumps suddenly increase their speed under certain contingencies. Very precise instructions indicate to those running the pumps the three different heights at which this water column should be maintained, for the unequal service of morning, afternoon and night. To his surprise the author found these instructions rigidly adhered to, and concludes that the results obtained in Amsterdam are due to the following special conditions: A phlegmatic population, unchanging in its habits; the use of small reservoirs in the private houses; the employment of a methodical class of workmen, and the use of pumps with a great range of power.

Three pumping engines, each of 150 nominal horse-power, furnish the supply for the city. These engines are compound with the two cylinders in the proportion of 3 to 1. The normal velocity is 26 strokes per minute, but this can be reduced to an exceedingly small limit. At night, one engine only is usually at work; in the morning a second is put to work, and the third is disposible of as a reserve. To meet the daily variations of demand, the speed of the engines is regulated accordingly. The power requires the burning of from 3.8 to 4 pounds of Belgian coal, per useful horse-power.

The author, in commenting on the Holland system, remarks that the absence of a reservoir increases by 50 per cent., the cost of coal consumed, as compared with French practice. And in addition, Amsterdam, with its 350,000 inhabitants, has a daily water supply of only 4,750,000 gallons, or less than 14 gallons per head per day.

Sounding in Pipes by Metallic Potassium.

In connection with the preliminary investigations for the introduction of the Improved Sewerage Schem into Boston, Mass., an ingenious, if not novel, method was successfully tried for obtaining the height of water in small test pipes driven into the ground. The purpose of the experiment was to test the effect of pumping upon the height of the ground water, and as the method may be of use elsewhere we give it as follows:

About twenty small pipes were driven into the ground below the surface of the soil-water and measurements taken twice a day of the height of water standing in these tubes. The elevation of the top of each pipe being accurately determined, the exact distance to the water surface in the pipe was obtained as follows:—To the ring of an ordinary metallic tape a small lead plumb was attached by a wire hook; the top of this plumb was flat and in a hole to one side of its center was forced a cork and in this cork a needle was fixed upright, eye down, so that its point was just on a line with the bottom of the tape ring. A small bit of metallic potassium was put on the needle-point and the tape lowered into the pipe; the instant the potassium touched the water it ignited explosively and the flash and sound both gave the exact moment for reading on the tape the required depth to the water-line.

The Present Cost of the Pedestal of the Statue of "Liberty."

Gen. Chas. P. Stone, Engineer-in-chief, has submitted a report to the executive committee accounting for an expenditure to date of $231,455.45 on the foundation and pedestal for the statue of "Liberty" to be erected on Bedloe's Island.

This sum is itemized as follows: Demolition, excavation and test-boring of site, $5,124.50; paid to contractors for concrete foundations, $51,032.04; cement purchased by committee $29,787.30; inspectors, $7,722.55; extra labor, $2,904.17. The 11,681 cubic yards of concrete now in place, including drains, grouting, and other incidental work, was $93,830.94, making the total cost of concrete $7.28½ per cubic yards.

After carefully considering the question of material for the pedestal, the committee have adopted the plan of Engineer Stone, proposing a facing simply of cut stone with a beton backing. A contract for this pedestal, in accordance with the plans of Architect Hunt and specifications of Chief Engineer Stone, has been entered into with D. H. King, Jr., for the sum of $132,500; this contract was signed on May 16, 1884, and the granite from Lute's Island, Conn., has been selected. Mr. King has been paid in cash and material, to August 15, 1885, $92,729.77.

In regard to pedestal detail, Gen. Stone reports as follows:

The plan which I made for the interior of the pedestal, is of extreme simplicity, and is intended, above all else, to secure stability, strength and durability in the structure. A vertical shaft, 27 feet square from base to summit, is inclosed in walls 17¾ feet thick at the base, and 6 feet 2¾ inches thick at the summit. The exterior is of granite, of average thickness, more than three feet, the remainder of the walls being of béton, composed of one part of best Portland cement and four parts of trap-rock screenings, carefully mixed and rammed in layers of 6 inches in thickness. Four arched passages through the walls correspond to the doorways of the four faces of the pedestal and give entrance to the shaft, while arched galleries in the walls give opportunity for circulation, take off superfluous weight, and effect economy of material while preserving large bearing surface in the foundation mass. The matter of the proper method of fastening the statue firmly to the pedestal was one of great importance, and required much careful study. It seemed to me necessary that a system be devised which could always be visited in all its parts to give opportunity for painting or repairs and capable of slightly changing strains to meet great changes of temperature. The plan adopted fulfills these conditions, and has been constructed to resist, with a proper factor of safety, a wind strain of 100 pounds to the square foot of surface on the statue. The steel work has been admirably prepared under strict specifications and inspection. Mr. Schneider, the well-known engineer of the new Niagara bridge, was charged by your engineer-in-chief with the inspection duty. The four lower girders are already in place. Awaiting them and placing them caused a delay in the masonry construction of the pedestal of nearly four weeks.

PERSONAL.

T. G. SHAUGHNESSAY has been appointed Assistant General Manager of the Canadian Pacific R. R. and all its lines.

Civil Engineer R. E. PEARY is detached from duty at Coaster's Harbor Island, Newport, R. I., and ordered to continue on present duties under civil engineer Menocal at Washington.

MR. T. W. WRIGHT, formerly assistant on the U. S. Lake Survey, and during the past two years Instructor in Civil Engineering at Lehigh University, has been appointed to the professorship of mechanics in Union College, and will enter upon his duties there at the beginning of the fall term. Prof. WRIGHT is the author of a well-known treatise on the adjustment of observations.

WILLIAM B. KNIGHT, late City Engineer of Kansas City, has been elected Chief Engineer of the Wyandotte, Nebraska & Northwestern R. R. Co. and is now engaged in pushing the surveys.

OCTAVE CHANUTE, C. E., has been elected Vice President in charge of Section D, (Mechanical Science) of the American Association for the Advancement of Science. It is a most happy selection.

SUPERINTENDENT JOHN FRITZ, of the Bethlehem Iron Company, has not resigned, but is now on his way to this country from Europe, where he was for several weeks in the interest of the company. His assistant and principal draughtsman of the works, Owen Leibert, has tendered his resignation, and will locate in the West.

COL. WILLIAM YOLLAND, R. E., F. R. S., is dead. Col. Yolland was born in 1810, was educated at the Woolwich Military Academy, and obtained his commission as Second Lieutenant of Royal Engineers in 1826. He rose to the rank of Colonel in 1858. He served in Canada, at the Ordnance Map Office, at the Tower of London, and at Phœnix Park, Dublin.

DWIGHT E. PIERCE, a graduate of the Sheffield Scientific school and afterwards a teacher in the Hopkins Grammar school, died at Bristol, Tuesday evening, Sept. 1st. From 1877 to 1881 he was instructor in engineering at Lehigh University, in Pennsylvania, and then became president of the Lloyd Valve company of Bethlehem. At the time of his death he was visiting his uncle in Bristol.

COLONEL J. A. FICKINGER, chief engineer of the Ohio River Railroad, has been for some days at Point Pleasant, W. Va., engaged in making one more effort to secure the right of way on the river route. This, he says, is the last chance Point Pleasant will have offered her to take hold and do her share toward extending the road. The town and Mason county cannot afford not to have the improvement completed.

WILLIAM FRAISSE, a distinguished Swiss civil engineer and politician, died a few weeks ago at Lausanne, in his eighty-fourth year. He carried out the great Durana Canal for supplying the city of Marseilles with water, and planned the fine aqueduct of Roquefavour. He superintended the construction of the entire system of the Western Swiss Railway Company. Other important works in which he took part were the connection of the waters of the Jura, the Orbe, the Broye, and of the Upper Rhine in the cantons of Graubünden at St. Gallen.

GEORGE J. JOHNSON.—This mining engineer and metallurgist, of Boston, Mass., died Aug. 27, at Old Orchard Beach, Maine. Mr. Johnson studied at the Boston Latin School, 1861; Harvard University, 1865; Frieberg, Saxony, School of Mines, 1867; and subseqently studied in a laboratory in Paris. In 1868, he was professionally engaged, and was a proprietor of the Salt Lake Smelting Works. In 1876, he returned to Boston, where he practiced his profession, in which his opinions were considered reliable and conservative. Mr. Johnson was a man of large means, and made heavy and judicious investments in many directions. His death was caused by appoplexy.

FREDERICK BROWN PARRISH, son of George H. Parrish and nephew of Charles Parrish the two most prominent coal men in America, died September 3rd, at his Summer home on the Wilkes-Barre Mountain, aged 36. He had been a severe sufferer for many months from a complication of diseases, of which towards the last, paralysis was one. Mr. Parrish was born in Pierremont, Rockland County, N. Y., and spent his boyhood in the West, chiefly in Kentucky. The family moved to this city in 1862. Frederick attended the Lawrenceville N. J., Academy for a number of years, working as engineer in the vacation, in this vicinity. In 1870 he was appointed one of the engineering corps of the Lehigh and Wilkes-Barre Coal Company, and in 1872 was placed in charge of the corps. In 1874 he was made assistant superintendent to his father, then general Superintendent of the Leeigh and Wilkes-Barre Coal Co., and shortly after was made general Superintendent of the firm of Charles Parrish and company. At the time of his death he was president of the Hillman Vein Coal Company, of the Hanover Coal Company; vice-president of the Red Ash Coal Company: director of the Pittston Engine and Machine Company, and a member of the Western Anthracite Joint Committee.

CORRESPONDENCE.

The Efficiency of Fluid Vapor Engines.

320 W. LANDALE St., BALTIMORE, MD., August 30, 1885.

EDITOR ENGINEERING NEWS: Having seen in the August issue of your journal, the statement that it was capable of proof that steam was just as efficient a working fluid as the vapor of Bisulphide of Carbon. I take pleasure in sending you an exhaustive proof of it.

Yours truly, H. L. GANTT.

The "exhaustive proof" is an article under the heading to the above letter, which was contributed by our correspondent to Van Nostrand's Magazine of 1884, and which may be easily obtained by parties interested in the subject. Judging from the evidences of careful study and labor bestowed upon the article in question by Mr. Gantt and his co-laborer, Mr. D. H. Maury, Jr., we think the proof must be fully demonstrated.—ED. ENG. NEWS.

To Find the Angles of a Triangle with Given Sides.

BALTIMORE, Sep. 2, 1885.

EDITOR ENGINEERING NEWS:—The following is a substitute for the method in general use for computing the angles of a triangle when the sides only are given. As the formula is based on a mathematical solution of the problem, and gives exact results, its publication will probably be useful to a large number of your readers.

$$\text{Cos } A = \frac{a^2 \sim (b^2 + c^2)}{2\,b\,c}$$

in which a, b and c represent the three sides, and A the angle opposite the side a. The sign "$\sim$" means "the difference between."

Example $a = 20$, $b = 21$, $c = 22$.

Angles Corresponding.

$$\text{Cos } A = \frac{20^2 \sim 21^2 + 22^2}{2 \times 21 \times 22} = 0.56818\ldots\ldots 55^\circ\ 23'$$

$$\text{Cos } B = \frac{21^2 \sim 20^2 + 22^2}{2 \times 20 \times 22} = 0.50341\ldots\ldots 59^\circ\ 46'$$

$$\text{Cos } C = \frac{22^2 \sim 20^2 + 21^2}{2 \times 20 \times 21} = 0.425\ldots\ldots 64^\circ\ 51'$$

When the sum of the angle, as computed, is less than 180°, the largest angle is equal to the sum of the two others, and shows that its supplement must be taken.

Example $a = 100$, $b = 110$, $c = 200$.

Angle Corresponding.

$$\text{Cos } A = \frac{100^2 \sim 110^2 + 200^2}{2 \times 110 \times 200} = 0.95682\ldots\ldots 16^\circ\ 54'$$

$$\text{Cos } B = \frac{110^2 \sim 100^2 + 200^2}{2 \times 100 \times 200} = 0.9475\ldots\ldots 18^\circ\ 39'$$

$$\text{Cos } C = \frac{200^2 \sim 100^2 + 110^2}{2 \times 100 \times 110} = 0.81364\ldots\ldots 35^\circ\ 33'$$

Here $35^\circ\ 33' = 16^\circ\ 54' + 18^\circ\ 39'$, and the angle $C = 180^\circ - 35^\circ\ 33' = 144^\circ\ 27'$.

So far as I know, the above is much the simplest formula that has yet appeared for the determination of angles of a triangle in terms of its sides.

Yours truly,

CONWAY R. HOWARD.

Whitewash on the Capitol.

BOSTON, Sep. 1, 1885.

EDITOR ENGINEERING NEWS:—The following is said to be the recipe for making the brilliant stucco whitewash used on the outside of the Capitol at Washington.

Take half a bushel of good unslaked lime, slake it with boiling water (cover it during the process to keep in the steam); strain the liquid through a sieve and add to it a peck of salt dissolved in warm water, three pounds of ground rice boiled to a thin paste; stir in, boiling hot, ½ pound of powdered Spanish whiting, one pound of white glue; add five gallons of hot water; let the mixture stand a few days covered from the dirt, and apply with a kalsominer's brush.

C. H. W. WOOD.

Civil Engineers of the South.

JACKSONVILLE, Fla., June 24, 1885.

DEAR SIR: Several members of the profession of Civil Engineers in this and adjoining States, have expressed a desire to form a Society or Club of Civil Engineers of the South, for mutual advancement and social intercourse. It is well known that these societies are numerous in the North and West, while none are believed to exist of Southern Engineers.

The advantages of these societies are very great to the members, in uniting in a fraternal bond the scattered members of what is now a numerous and rapidly increasing profession.

All members of the profession in the South are cordially invited to join in this movement. For this purpose you are personally requested to attend a meeting to be held in this city on September 24 1885, at the office of J. Francis LeBaron, C. E., Room 3, Bostwick's Block, corner of Bay and Pine streets, at 10 o'clock A. M., (Standard Time) for the purpose of assisting in perfecting an organization.

H. S. DuVal, State Engineer; S. B Carter, Chief Engineer J., T. & K. W. R. R.; Chas. F. Smith, Chief Eng'r International R. R. and S. S. Co; J. Francis LeBaron, Civil Eng'r. Member A. M. Society C. E.

LITERATURE.

The Preservation of Timber by the use of Antiseptics. By SAMUEL BAYSTER BOULTON, Assoc. Inst. C. E. Van Nostrand's Science Series. No. 82, 1885. Price 50 cents.

Mr. Boulton treats of the artificial preservation of timber from the earliest known period, but enters fully into the detail of the more modern practice, dating chiefly from the introduction of railways and the increased necessity for the preservation from decay thus brought about. It is a carefully written and very complete detail of all the prominent or practicable methods The discussion by well known experts is also included and is as valuable as the original paper itself.

A Guide to Sanitary House-Inspection; or Hints and Helps regarding the choice of a healthful home in city or country. By WILLIAM PAUL GERHARD, C. E., consulting Sanitary Engineer; author of "House Drainage and Sanitary Plumbing," "Hints on the Drainage and Sewerage of Dwellings," and "Diagram for Sewer Calculations." 16mo. 1885. John Wiley & Sons, Publishers, New York. Price. $1.25.

The above is intended by its author for the use of architects, civil engineers, builders, health officers, sanitary inspectors and physicians. In it he broadly outlines the main features of a sanitary house-inspector, so that it may prove a guide to those in search of defects. The details of this subject are more minutely treated in the other works of the author referred to in the title. As the necessity of sanitary inspection and the correction of existing evils is being daily more and more recognized, Mr. Gerhard's hand-book is a timely production.

A Treatise on the Adjustment of Observations, with Applications to Geodetic Work and other measures of precision. By T. W. WRIGHT, B. A., C. E., New York, D. Van Nostrand, 1884.

This very neat octavo volume of 437 pages treats of the adjustment of observations by the method of least squares. This method was introduced about 1810 by Gauss and Legendre for the discussion of the delicate measurements of astronomy and geodesy, and has now become universal in all branches of science for the adjustment of measures of precision. To the civil engineer the value of the method lies not merely in its results, but also in acquainting him with the nature of accidental errors and the law of their distribution, a knowledge which will react upon his observations and render his work better than before.

The author, now Professor of Mechanics in Union College, is peculiarly fitted to discuss this subject, having been long engaged upon the geodetic triangulations of the U. S. Lake Survey, and most of the examples and illustrations of his book have been taken from cases with which he has been connected. Hence the work cannot fail to be of interest and value to all geodetic engineers. The scope of the book is far beyond any hitherto published in the English language, and embraces not merely the theory of the adjustment of a triangulation, but also the practical methods of computation. The development of the general theory of the subject occupies 240 pages, the discussion of the adjustment of a geodetic triangulation embraces 99 pages;

of base-line measurements 22 pages, of levelling 24 pages, of the calibration of thermometers 13 pages, of empirical formulas and interpolation 19 pages. These subjects are handled not only with clearness and fullness, but with an ability which puts the author in the front rank of geodetic authorities.

In comparing the precision of measurements, the mean-square-error is generally employed instead of the probable error. The slight advantage in computation thus gained is, we think, more than overbalanced by the awkwardness of the term and the fact that the probable error is already almost universally used in this country. The motto on the title page might seem to imply that the science of least squares would produce good results from poor measurements, but such is certainly not the meaning of the author. This book will do much to encourage both precise observations and their sound scientific discussions among civil engineers.

Water Meters, Comparative Tests of Accuracy, Delivery, etc.—Distinctive Features of the Worthington, Kennedy, Siemens and Hesse Meters. By Ross E. BROWNE, Mem. Tech. Soc. Van Nostrand's Science Series, No. 81. Price 50 cents.

This interesting treatise is reprinted from the Proceedings of the Technical Society of the Pacific coast of which Mr. Browne is an active member. These trials were primarily instituted to test the efficiency of the meter invented by Professor F. G. Hesse, and the other tests were comparative. The writer regrets that missing data did not allow him to include the "Crown" and other well known meters in the test. The work seems to be very carefully done and the record is of value as giving the close details of the methods used; the Hesse meter is given especial prominence, as was perhaps natural under the circumstances, and its record is rather better than that of its competitors on a general count. The book is well illustrated.

The Practical Estimator, being a companion and Key to Handy Estimate Blanks. Containing directions for preparing Builders Estimates, together with numerous Tables and Rules useful in such work. Also a list of all the items ordinarily entering into a building, so arranged as to be a Convenient and Systematic Reminder of the Items to be listed. By J. D. SIBLEY, Architect and Builder, and A. O. KITTREDGE, Editor "Carpentry and Building." David Williams, Publisher, New York, 1885, 16mo. pp. 96. Price $1.00.

This is decidedly an enterprise in the right direction and well carries out its expressed intention of reducing to a system a class of work that is usually almost chaotic. It is to be used in connection with the "Handy Estimate Blanks," and is a key to the use of these blanks, in addition to the other useful matter embraced in the title. These blanks are truly labor-saving, and prevent the omission of items, to the annoyance and often loss of the contractor or architect. They serve two purposes, first to estimate the probable cost; and secondly, to compare this estimate with the actual cost, blanks being left for both sets of figures. Incidental but important features are the compact and uniform shape of all records so made and their convenience for future use. In building estimates especially, the multitude of items make systematic work absolutely necessary, and these blanks will be useful as reminders even if the blanks themselves are not used.

TRACK.*

BY W. B. PARSONS, JR., C. E.
ROADMASTER SUSQUEHANNA DIVISION ERIE R. R.

(*Continued from page 154*).

Having described the materials which form the "Permanent Way" and its appurtenances, together with the tools by which these materials are worked, the following chapter will relate to the proper use of the same:

While of course, the general idea of all work should be the steady improvement of track, it can be said that the immediate principle of details is that the work of one season is devoted to the preparation for the next.

During the winter when not engaged in handling snow, everything possible should be done to ease the rush of work in the busy time of spring and summer, and the chief of such aids is getting the ties ready. This should be thought of and done early in the season, and ties loaded, sent out, and distributed along the track in those places where they will be needed later, so that every tie will be on the ground before the season opens. By beginning early this work can be carried on at convenient times, and during a part of the year when traffic is usually light, and unnecessary expense thereby avoided. Labor can best be spared in the winter rather than in the spring when the gangs should be steadily employed in tieing up their track, which latter work when once begun should not be delayed by short supply of material, or by taking their valuable time for unloading and distributing. When ties are thus distributed several months ahead, it is better for the sake of general appearance to pile them up about thirty or forty together in square piles rather than to leave them scattered along the banks or choking up the ditches.

When frost leaves the ground and while the track is settling in place, as soon as the shims put in during the winter are taken out, the fences (unless looked after by a special gang, as should be done,) must be run over and repaired, then the bad ditches cleared of obstructions to make place for the spring rains, followed by rapid tidying up of the section, after which the labor of putting in the ties begins. Once started this should be prosecuted with as much vigor and steadiness as possible. The best time for putting in ties is the spring, when the days are cool, men fresh, and the ground soft and not baked by the sun. Since at this time more can be accomplished with each day's labor, a temporary increase of force will be found economical. If possible, track should be entirely tied up before grassing begins, which operation, consisting of mowing the right of way, cleaning the ditches, and grubbing the track, should be done before the weeds go to seed. If the ballast is poor it may be necessary to grub the track three times, or even more, if a neat appearance is desired, while with gravel, once or twice, according to its freedom from soil; and with broken stone, provided it is of full depth, not at all. The rest of the season can then be devoted to surfacing, lining and getting the track ready for winter.

Inasmuch as it is not advisable to stir track up just before winter, it should not be touched except for low joints or necessary repairs, during the four weeks preceding frost. This time should be devoted to building fence, weeding track, and good generous ditching. Culverts and bridges openings should be examined and cleared of all drift-trash and obstructions. All rails and material likely to be needed should be placed on skids, to as not to be lost in the snow, and planks at turn crossings should be taken up.

TO BE CONTINUED.

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WATER

WATER-WORKS are soon to be built at Ellsworth, Kan.

PLATTSMOUTH, Neb., is hopeful of securing water at an early day.

COLUMBIA, Dak., will invest $3,500 in a 1000-foot artesian well.

THE Southern Pacific Railroad Company will sink a well at Lordsburg, N. M., to supply the town with water.

THE Selings Grove Water Company, of Selings Grove, Snyder county, Pa., was organized Sep. 3rd. Capital stock, $50,000.

PLYMOUTH, New Hampshire, is wholly without a water supply owing to non-payment of water rental by the fire district.

A COMPANY of Mormons is to build, in Arizona, an irrigating canal, 20 feet wide and 16 miles long, hoping thus to reclaim 20,000 acres of ground.

THE new Pierre Dakota water works have been tested and found to be satisfactory. The capacity of the pumps is 1,000,000 per day.

J. H. FANNING, of Manchester, N. H., is making a general examination of the water system of Minneapolis, Min., with the purpose of its improvement.

THE El Paso Water Company has filed a charter for damming the Rio Grande river into a canal for irrigation purposes; capital $35,000.

A COMPANY is talked of to build electric-light and water-works in East Dallas, Tex.

PIPES are being laid in Warsaw, Wyoming County, N. Y., on several streets, both for water and gas.

FREMONT, Neb., September 1.—At a special election in this city to-day, on a proposition to issue $25,000 bonds for the construction of water works, the proposition was carried by a heavy vote—four-fifths majority.

THE Scranton, Pa., Water Board is considering a proposition from Samuel McEachen to sink an 8-inch well hole for $3.50 per foot. If it is to be pumped, he guarantees 22,000 gallons per day and furnishes pump and all necessary for $3,000.

THE Austin, Texas, Lunatic Asylum board have made a new contract with the Waterworks company for water for laundry, sanitary purposes, and all purposes except for fire, which is under separate contract. The company furnishes water at $2000 per year.

THE Mankato, Minn., Construction company is now putting in gas mains at Hastings, Neb and will supply the city with gas, and have received the contract for laying water mains for the same city. Work on the latter will be commenced next spring.

THE storage reservoir, which was supposed to make scarcity of water in Brooklyn a practical impossibility, is now empty, and the danger of a water famine is becoming imminent. Marsapequa pond in South Oyster Bay, was on Sept. 7th., acquired by the Brooklyn city authorities, to help out the water supply.

THE managers of the State Asylum for the Insane at Morris Plains, N. J., are consulting in regard to the sanitary improvement of the Asylum. The sewage disposal, as well as inside fixtures are under discussion. The matter is referred to a special committee, of which Hon. Geo. A. Halsey is chairman.

THE Portsmouth, N. H., aqueduct company's employes took up some aqueduct logs a few days since which had been down more than half a century. The logs were found to be in fair condition. The water had worn the original two-inch orifice to a diameter of three inches.

THE water service of Concord, N. H., is being extended. The total length of the extension is 2,900 feet and the cost will be about $2,000.

The contract for furnishing and laying the pipe for the county farm water works has been awarded to Sherburne J. Winslow of Pittsfield.

LANCASTER, Penna., wants $7,000 to pay water charges for the remainder of the year. The Meilert Foundry and Machine Co., of Reading, received the contract for the 20-inch main; the laying will not be done until next spring as the pipe cannot be furnished in time.

FLUSHING, Long Island, is to try driven wells to obtain more water. Mr. Andrews has offered to provide 2,000,000 gallons for $15,000: but James Dallard proposes to give the same quantity for $5,000. The two contractors will be allowed to demonstrate their systems.

THE West Troy waterworks company, it is said, have threatened to take up the hydrants in Green Island unless the village authorities accede to the terms offered by the waterworks company, which are that the village be furnished with water sufficient for fires, etc., at $2,000 for the first three years and $2,500 a year thereafter.

CONTROLLER LOEW told his fellow-members of the Aqueduct Commission, Sept. 2nd., that he had sold $1,000,000 of water bonds at 3 per cent. interest, from which he had realized $1,017,163. Chief Engineer Church reported that the length of the three new sections of the aqueduct would be 13,643 feet.

ENGINEER PETTEE, of Peabody, Mass., reports pumping 17,888,020 gallons of water in the month of August, an average of 577,032 daily, consuming 1385 pounds of coal daily, a total of 42,916 pounds. The average per pound of coal was 416 gallons of water. The average running time daily, 7 hours.

PONTIAC, September 3.—The Common Council and citizens of Pontiac, Mich., have of late been agitating the question whether it is advisable for Pontiac to have water works. The sentiment is growing stronger in favor of water works. A few weeks ago a committee of the Council visited several of the cities of this State which have water works with a view to ascertaining the probable cost of introducing the same and which would be the best system. The Council held a meeting last evening and decided to get up an excursion to Windsor to inspect the workings of the system there one week from next Saturday.

EAST ORANGE, N. J.—The East Orange Township Committee received a report, August 24th., from W. H. V. Reimer, civil engineer, who was engaged last June to prepare plans for the drainage of various parts of the township. The aggregate cost of the works proposed is about $100,000.

CARBONDALE, Pa., September 4.—An epidemic of typhoid dysentery has broken out in Waynart, Wayne County, and is spreading to an alarming extent. Thirty-five cases have developed, and there have been seven deaths. The cause of the disease is said to be impure water and poor drainage. A similar epidemic prevailed there in 1874.

THE Des Moines Committee on Water Works and the company have been holding sessions of late to determine the rate the city shall pay for the next five miles of main to be constructed. After several heated sessions an agreement was finally entered upon recently whereby the city is to pay an annual rental of $700 per mile, and the company is to extend its lines across Coon.

ARTICLES of incorporation have been filed in the Secretary of State's office of the Meeks & Daily Water Company, for the purpose of acquiring and disposing of water and water rights in San Bernardino county. Principal place of business, Colton, Cal. Directors—P. J. Stockman, M. C. Lujan, G. A. Hunter, M. A. Murphy, and William H. Mentzer. Capital stock, $78,000, divided into 780 shares of the par value of $100 each.

WATERBURY'S WATER WORKS.—The water works election in Woodbury, N. J., resulted in adopting the law which gives the city the authority to build the works, there being a majority of eighty-three votes in favor of it. The whole vote polled was only 379, out of a voting population of about 800. The estimated cost of the works, according to the survey and plans of engineers, is $67,000; and the source of supply chosen in Mantua Creek, above tide water, at a point four miles from Woodbury. The kind of work contemplated is the reservoir system. The probability is that a contract for building the works will be made soon.

THE El Paso Waterworks and Irrigation company chartered several years ago, has placed a corps of engineers in the field to establish surveys and report the number of acres of land that can be rendered cultivatable along the route proposed. The originators of the gigantic enterprise are well-known southwestern contractors, and all preliminary work is being done at their expense. When surveys are completed subscriptions to the capital stock—$300,000—will be solicited in New York. A. B. Leet, formerly general freight agent of the Chicago and Alton railroad, has been appointed pool commissioner of the lines centering at El Paso, and will assume charge of his duties in a few days.

AT Merthyr Tydfil, Wales, the sewage of 40,000 people passes from the town, three miles distant, by the action of gravitation. On its way it passes or flows through a straining tank filled with refuse slag from the iron works, by which the coarse parts are intercepted, and it is finally distributed through covered earthenware pipes upon a field of twenty acres, divided into four plots of equal size, each of which is used six hours at a time, with eighteen hours of rest for aeration. The sewage flows uniformly over each plot, with a fall of one foot in 150 from the conduit to the main under drain, where it is arrested by an embankment. This main under drain is six feet deep, and serves to carry off the effluent to the river; the lateral deep drains are of the same depth, and placed only twelve feet apart. The soil is well adapted to the system, being a light loam with a deep, gravelly subsoil, and the effluent is quite pure. Intermittent downward filtration is also said to be successfully resorted to in other towns.

BROOKLYN WATER SUPPLY.—The condition of the water supply is such as to prompt the city authorities to take measures to check the waste. Purveyor Milne estimates that fully two million of gallons are needlessly used daily. He says this must be stopped. The average daily consumption during the month of August was 42,500,000 gallons, while during August last year it was but 38,500,000. The ponds and streams are very low, the storage reservoir at Hempstead is down to the flow line, the water being but 3¼ feet in depth; the distributing reservoir at Ridgwood has run down from 22 to 14½ feet, and the three great engines at the station on the East New York plains are pumping less than the daily consumption. Mr. Milne says that the rainfall thus far this year has been 10 inches less than it was during the corresponding period of last year; which accounts in large measure for the low condition of the ponds and streams. From the driven wells at the Spring Creek, Baisley, Clear Stream and Forest Stream Stations the city must be now deriving at least 20,000,000 gallons daily. Were it not for these works the city would be in a sorry plight today. They have proved remarkably successful and the constructing firm, Cranford & Andrews, and Brooklyn's accomplished engineer, Mr. Robert Van Buren, are entitled to great credit on that account.

Purveyor Milne has ordered the regular inspectors attached to his bureau, and four newly appointed inspectors to visit every building in the city for the purpose of checking the waste of water. This waste is caused in a variety of ways. In very many cases it is because of defective plumbing, and in others the people purposely allow the water to run continuously. The Purveyor thinks that by the house to house inspection he can save 2,000,000 gallons daily. He says it is rather an unpleasant business for housekeepers, perhaps, but it is absolutely necessary, and will be conducted with as little inconvenience to them as possible.

PLANS and specifications for a system of water works at Hastings, Neb., are being drawn up, and this fall the citizens will have an opportunity of voting to bond the city for $75,000, which will no doubt be unanimously carried. The system is to be complete in every detail.

THE Curtis Regulator Co. of Boston, have recently supplied the Water Works Co. of Helena, Montana, with 9 large pressure regulators for their street mains. The office of these regulators is to reduce the water pressure from 160 pounds to 80 pounds in the mains, thereby taking off the excessive pressure from the service pipes, which is so injurious to fixtures, hose, etc.

THE Government survey for bringing water into Guanajuato, Mexico, is pressing with every prospect of success. Governor Gonzales seems determined to have the city supplied with pure water. It will be brought five leagues across the mountains. It is also said Governor Gonzales will next commence work upon a theater, upon which $150,000 has been spent. When completed it will not be surpassed by any in the republic.—*Mexico.*

THE WATER DRINKER'S DREAM.

"Gulped down infusoriæ,
And quarts of raw bacteriæ,
And hideous rotatoriæ,
And wriggling polygastricæ,
And slimy diatomaceæ,
And hard-shelled ophryocercinæ,
And double-barrelled kolpedæ,
Non-loricated amboedæ,
And various animalculæ,
Of middle, high and low degree.
For Nature just beats all creation
In multiplied adulteration."

NEW WATER-WORKS IN NEW JERSEY.—There is a project on foot to form a water company for the purpose of supplying the three villages of Madison, Chatham, and Summit. The projectors purpose erecting the works and reservoir at or near Madison, and get the supply from Shewongunk and Mount Tabor lakes. The Madison *Eagle* says: "Shewongunk Lake is three miles from Mount Tabor Lake, and covers 120 acres. This also is a spring lake, surrounded on the north, west and south by mountains, its overflow is at the east, and flows into the Rockaway through Den Brook, the stream of water passing near the railroad station at Denville. Shewongunk Lake is 684 feet above tide water, and 184 feet higher than Mount Tabor Lake. Den Brook is less than three-quarters of a mile from one of the springs that flows into Mount Tabor Lake, and at small expense and by open channel the water of Den Brook will flow by gravity into Mount Tabor Lake. By actual measurement the average daily overflow of Shewongunk Lake in the months of July, August, and September is 682,560 gallons."—*Newark Advertiser.*

WATERING PLACES IN ARID WASTES.—EL PASO, TEX., September 2.—East of El Paso, on the way to Fort Worth, and at the distance of fifty miles from the former city, Liebe Hucka tanks are the only water supply for a hundred miles in diameter. The Hucka consists of a vast conglomeration of volcanic rocks rising out of a level plain, and inclosing a large natural depression, in which, during the rainy season, enough water accumulates to last throughout the remainder of the season. These natural tanks have been a great accommodation to travelers, and showed at no time a lack of water until lately, when owners of large heads of cattle coming from Central Texas or the Indian Territory, in passing that way to New Mexico or Arizona, would stop with their stock for days and days at the tanks, and seriously diminish the supply of water. To obviate any unnecessary waste, the Board of Trade of El Paso obtained control of the water supply from the owners of the land, and to-day publish notice that no longer stay than twenty-four hours would be tolerated for any future droves of stock. The notice has been published all over Western Texas, and will be rigidly enforced.

MILWAUKEE WEATHER RECORD FOR AUGUST.—Last August was the coldest on record; at least, it was the coldest since the establishment of the Milwaukee station in 1870. The comparative mean temperature was 63 degrees and 1 minute. The next coldest was in 1875—64 degrees and 7 minutes. The rainfall for the month measured 7.39 inches, which also beats the record of any corresponding month in any year since 1870. The nearest approach to this was in 1877, when the fall was 6.31. During the past month there have been a great many thunder storms. They occurred on the 3d, 6th, 8th, 9th, 12th, 17th, 18th, 20th, 21st, 23d, and 24th. The heaviest rainfall was on the 6th, when I recorded 2.09 inches. The next heaviest was on the 18th, when 1.41 was recorded. Fourteen out of the thirty-one days of the month were marked by rain. There were no frosts in Milwaukee, although some have been reported from towns at not a great distance from the city. The highest barometer was 30.304, on the 26th, and the lowest, 29.566, on the third. The highest temperature was recorded on the 12th, 85.5, and the lowest on the 15th, 46.3. The prevailing direction of the wind has been southeast, with a total movement of 7,792 miles, attaining the highest velocity on the 13th, when it blew in a northwesterly direction, at the rate of 30 miles an hour.

WELLSBURG, W. VA., has decided by vote to build water-works.

LAST year the water-mains of Leipzig were cleared by chemicals. The pipes experimented upon were those conveying water from the pumping-station to the town reservoir. This main is about 15½ inches in diameter, and 2 miles 1,444 yards long. The incrustation was from ⅛ to 1 inch thick and in some places still thicker. The operations lasted more than nine weeks, and during that period, at intervals, the pipe was filled with dilute hydrochloric acid eight times, with soda solution three times, and with a solution of chloride of lime once (being washed out thoroughly with water between the successive applications). It is stated that the incrustation was entirely removed; the practical effect of the cleaning being indicated by pressure gauge—a decrease of from 1-8 to 2 atmospheres pressure at the pumps.—*Sanitary World.*

MR. MASON gives as the most effective destroyer of cholera germs in excretions the following solutions:—Solution of sulphate of copper in the proportion of not less than 2 oz. to 1 quart of water; liquid chloride of zinc ½ oz., to a quart of water; bichloride of mercury ½ oz. to a quart of water; bichloride of copper, 2 oz. to a quart of water; sulphuric acid, 4 oz. to a quart of water. The same chemicals are used for disinfection of water-closets, sinks, and all other seats of decay or infection. For washing streets and drains, sulphate of iron, 10 lbs. in 220 gallons of water, or liquid chloride zinc, 20 lbs. in 220 gallons, has been found most effective and practicable. Phenic acid, in the proportion of 10 lbs. to 220 gallons of water, was largely used at Marseilles last year, but the results were less satisfactory than expected, some experts even going so far as to affirm that the phenic principle preserved rather than destroyed the germs of the contagion. He says that in the face of a cholera epidemic diarrhœa is a serious illness, and should be treated accordingly. He also says that, as a popular remedy for immediate use, nothing has been found superior to chlorodyne, sold by most druggists.

SALSBURY, ENGLAND, SEWAGE DISPOSAL.—The *Sanitary Record* says the designer had to contend with unusual difficulties, there being no available fall to spare, the sewage and subsoil water, amounting to upwards of 2½ million gallons daily, having to be dealt with without any interruption to its flow. The scheme is one of chemical precipitation, and includes two sets of four tanks each, seven of which can be used at a time. From the main sewer the sewage flows through a strainer, passes under the machinery building, where it receives the milk of lime by which it is precipitated, and then into the tanks. The effluent flows into a small stream which is frequented by some fine trout and other fish and thence into the river Avon, the condition of which is already greatly improved. When emptying a tank the top water is pumped on to a plantation of osiers; the sludge is then drawn by vacuum into an iron receiver, and thence driven by compressed air into two filter-presses. The sludge, which is pressed into one-fifth of its bulk, amounts to between two and three tons daily, in a nearly dry state, suitable for being carted away, and is being sold at about one dollar per ton. The work was continued during the night by the aid of electric light, and with great difficulty, owing to the sub-soil being loose gravel, and about 4,000 gallons of water per minute being continuously pumped out. The machinery is driven by one of a pair of six horse-power Otto gas engines, which are supplied with gas made on the works. The cost of these works was about $40,000.

ODD ESTIMATES PROBABLY.—The Water Works Trustees of Springfield, O., lately opened bids for the building of a water work shop, a three-story brick, with basement, and dimensions of 53x93¾ feet. The estimate cost was $6,000 as figured on the plans and specifications. Following are the bids in detail:

For the total work—R. A. Rowland & Son, $12,312, John Harding, $13,273, F. W. Jones, $13,784, E. W. Blair, $13,272.50.

For separate bids the following were received:

Excavation—M. Enright and P. Kelly, $585, Fred Erfurt $1,650, David Lewis $845, Walter Collins $875.

Stone-masonry—J. Brown $1,536, Fred. Erfurt $1,641, David Lewis $1,692.48, Walter Collins $1,635.

Brick-work—A. D. & G. M. Schneider $2,929.

Cast-iron work—Columbus Machine Company $665.

Tin and galvanized iron work—Kaiser Brothers $443, F. B. Ihrig, $445, Miller & Zimmer $633.

Plastering—Williamson & Barrows, $75.

Carpenter and hardware work—T. F. Jones $5,925, William King, $4,466.75, R. A. Rowland & Son $1,825, Beekey & Shoup $4,758, E. W. Blair $3,984.74.

Painting and glazing—John Fisher, $285, Stephens, Dessum & Co., $300, Fredolin Bommer $295, F. Bommer, $495.

Gas piping—John Harding, $39.

Asphalt—Walter Collins $375.

Cut-stone work—James Westwater Jr., $993.25.

As the bids do not vary in any marked degree, and the item bids run close, the probability is that the original estimate of cost was astray by about 50 percent. Collusion is possible, but hardly probable when so many are interested. Action is deferred by the board, until the unexpected figures are explained.

THE investigation of the water supply from Sudbury River and Cochituate has been concluded by the Norfolk and Suffolk Medical Society, and their report shows a serious pollution of the supply by sewage. It says that the water of Cochituate, which is the chief source of supply for Boston, is more dangerous to health than the Mystic water, and is daily growing worse. An analysis of the Cochituate water shows that by comparison with the water supplied to fourteen other cities, Boston's water contains the largest proportion of free ammonia and albuminoid ammonia, the products of sewage contamination.

A NEW water-meter, the invention of Mr. McCullum, surveyor and water-engineer, Blackburn, England has just been brought into prominence by the action of the engineer to the Blackburn Corporation. The following description may interest our readers:—This meter is on the tipping-tank or tumbler principle, and is a development of the inventor's waste-preventing cistern, but with the double tumbler instead of a single one. The meter is very interesting in its movements, and, being exceedingly simple, is exceptionally accurate. The tumbler works on a shaft, and, while one compartment is filling, the other is emptying into the canal; the weight of water in the one when full overbalances the tumbler, thus placing the empty compartment in a position to fill and do likewise. A mere glance is sufficient to show anyone how the quantity of water is measured. Near the top of each compartment there is a white line which represents the level of water when the tip takes place. The position of this line has been ascertained by measuring a certain quantity of water (100 gallons) with an officially-stamped measure; it therefore follows that every time the tipping-tank tips over one way 100 gallons enter the canal. This is recorded by dials in the usual way, and the accuracy can be further tested, if desired, by floating a box in the canal to catch a certain quantity of water after passing the meter, and then measuring the same with an official measure and comparing with the dials. The water is now running at the rate of about 1,250,000 to 1,500,000 gallons per day, but the meter can of course be regulated to measure either more or less; and the same principal can be applied on a larger or smaller scale.—*Sanitary World.*

WATER-WORKS FOR PALERMO, SICILY.

Translation of a Notice published by the Municipality of Palermo regarding the Water Supply of that City.—In view of supplying the town of Palermo with a sufficient quantity of drinkable water, the Municipal Administration has come to the decision to see which plan would be the best adapted to fulfil the following purposes.

1. That the water come from sources springing naturally to the surface. 2nd. That it possesses all the qualities of drinkable water, satisfying all the conditions reputed necessary to make it agreeable to the palate and salutary, and that the sole judge of this be the Municipal Administration. 3d. That it be a quantity sufficient to supply the wants of this city, taking into account the supply already in existence, which amounts to about twelve zappe (475 gallons per hour) and the probable increase of the population. 4. That the water be carried to the highest parts of the town and be capable of reaching the upper stories of houses. 5. That it be conveyed from the sources in open aqueducts, or in cast-iron pipes, and be distributed in the town in similar pipes or in wrought-iron tubes, adopting the most reasonable methods and those which practice has hitherto sanctioned.

In consequence of which, all companies connected with this business, those whose speciality it is to supply water, and others, are invited to present within the term of two months counting from the date of the present notice, *i. e.*, up to mid-day on the 28th of September next, in the hands of the syndic a complete project with particulars relating to the technical as well as to the financial and administrative branches of the affair. Notice is also given that a provisional guarantee of 25,000 lire (1,000*l.*) is to accompany the offers, and of an offer of a definite guarantee, corresponding to one-tenth of the estimate of the works to be accomplished, to be paid up in case of the definite acceptance of the offer.

The professional guarantee will be retained until the complete examination of the projects, after which, to those which will have been rejected will be returned the amounts deposited, retaining only the guarantee of the accepted project, it being understood that the said guarantee will revert to the municipality if the stipulated contractor does not come forward with the definitive guarantee. The necessary stipulations will, according to law, be submitted to the approval of the Municipal Council and of the authorities, and only then will they become obligatory. The municipality reserves to itself the right of the rejection of any offers without being obliged to indicate its motives for doing so.

(Mr. Henry A. Churchill, British Consul at Palermo, states that any company wishing to undertake these works should send out immediately a staff of engineers to survey the country in the neighborhood of Marineo, whence the water supply will no doubt have to come from. This locality, he says, is situated behind Monte Belmonte, which is a part of the chain that forms the "Conca d'Oro." The sources are high above the town of Palermo, and the mountain might be easily turned).

NEWS OF THE WEEK.

Railroads, Bridges and Canals.

Grand Rapids, Mich., wants more street railway, sewerage, etc.

The Northwestern not Going South.—NEW YORK, September 3.—Vice-President Sykes, of the Northwestern Railway, says there is no truth in the report that his company contemplates the construction of a line to Kansas City.

Canton Bridge Co.—The Austin, Texas, county commissioners adjourned Aug. 29. A contract to build two iron bridges in the town of Lansing was made with the Canton Bridge company; price $2,800. Three iron bridges in the town of Frankford were accepted.

Denver & Rio Grande R. R.—PUEBLO, Colorado, September 2,—Earle Brothers of this city have closed a $10,000 contract with the Rio Grande Road to straighten a lot of track near Howard and Mears stations. The work will be commenced at once.

Cable Roads.—NEW YORK, Sept. 2—The Brooklyn City Railroad Company, which operates forty miles of street railroad with 3,200 horses, proposes placing a cable railway on its main line from Fulton Ferry to East New York.

Severn Tunnel Finished.—LONDON, September 7.—Travel begins to-day for the Great Western Railway over the bottom tunnel that runs for two miles at a depth of forty feet below the bed of the Severn river, and which has been building since 1870. It shortens the journey from Cardiff to Bristol an hour and a-half

LOCKPORT, Sept. 7.—The long-talked-of East Lockport extention of the New York Central railway is at last a certainty. About one hundred men were engaged yesterday in getting everything in readiness to begin work this morning. It looks as though the regular "work train men" will do the work.

Work on the Schuylkill Valley.—Work on the Schuylkill branch of the Pennsylvania Railroad is being pushed with all diligence. Already more than five miles of track beyond Reading have been laid, and satisfactory progress is being made on the section between Pottsville and New Boston. Connection will be made with the Lehigh Valley at the latter point.

A New Indiana Road.—INDIANAPOLIS, IND., September 1.—The St. Joseph Valley Railroad Company, whose purpose is to build and operate a line from Mishawaka to South Bend, a distance of about five miles, has been incorporated, with a capital stock of $100,000, and Jacob Wolverton, William G. George and Charles A. Clark as Directors.

St. Clair River Tunnel.—The drilling party at the experimental work of the projected tunnel under the St. Clair river at Port Huron, now in progress by the Grand Trunk company, has finished four test shafts and are now at work on the fifth. The indications are said to still continue favorable, the material found being stiff clay with rock at the same depth of about 90 feet below water level.

Work Commenced—DUBUQUE, Iowa, Aug. 31st.—Blanding & McCormack, contractors, put 150 men to work on the Burlington & Northern, opposite Eagle Point, to-day. J. W. Fay, of this city, has been awarded the subcontract of the three miles extending from Fever river north. E. P. Reynolds, Sr., was in this city to-day, and in an interview said, about September 30th, more than 3,000 men would be at work between the Wisconsin river and Oregon, Ill.

A Kansas-Nebraska Project.—KANSAS CITY, Mo., Sept. 3.—William B. Knight, ex-City Engineer has been elected Chief Engineer of the Wyandotte, Nebraska & Northwestern Railroad Company and will place a corps of surveyors in the field next week and push forward the survey as rapidly as possible. The capital stock is $2,000,000. The road will pass through Wyandotte, Jackson, Nemaha, Marshall, and Jefferson Counties, Kansas, and into Gage County, Nebraska. It will be 150 miles long when completed to Beatrice and will connect with such thriving towns as Seneca, Holton, and Oskaloosa.

Railroads in British India.—The annual report for 1884-85 of Colonel F. S. Stanton, R. E., the Director-General of Indian Railways, shows that the total extent of railways open for traffic in India on March 31, 1885, was 12,004 miles, and that the extent of railway mileage under construction was 3,555 miles. The total capital outlay of the railroads and connected steamer service amounted on December 31, 1884, to £155,450,366 (at the conventional exchange of 2s. to the rupee), and the gross receipts during the calendar year 1884 amounted to £16,066,225, compared with £16,389,381 in 1883. The working expenses have been £1,156,157, as compared with £7,970,430. The net revenue amounted to £7,910,068. And with this may be compared the mileage of Canadian railways, which amounted at the close of the last fiscal year, July 30, 1884, to 9,949 miles. Thus it is seen that the two great English colonies have kept nearly apace in the construction of railways.

Twenty Thousand Dollars worth of bridges were swept away by the late floods in Page County, Iowa.

Manitoba Southwestern.—Donald Grant has been awarded the contract for the extension of the Manitoba Southwestern to Terherne.

The Kendall and Southern Kansas Bridge Company, organized for the purpose of erecting and maintaining a bridge across the Arkansas River, in Hamilton County, Kan., capital stock, $10,000.

The Tipton Railroad Company, with a capital of $50,000 was chartered at the Pennsylvania State Department recently. The new road will connect Tipton, Blair County, with the mines of the Tipton Coal Company. The directors are Philadelphians.

South Penna. R. R.—Most of the contractors for the construction of the South Pennsylvania railroad have agreed to assign their contracts to some person to be named by the construction company.

Railroad on Fifth Avenue, New York.—The Fifth Avenue Railway Company, with a capital of $2,500,000, to construct a horse railroad through Fifth avenue, New York, was incorporated on Tuesday.

A Maine Railroad.—The engineers are making a survey of the Short Line of Railway across the State of Maine. Another party started from Lennoxville, going west to Granby.

More Railroad Extensions.—SAN FRANCISCO, September 2.—The Southern Pacific Company have resolved to extend the terminus of the Los Angeles division from its present terminus at Mojave to Sumner, a distance of eighty-six miles north of Mojave.

W. Virginia Railroads.—A Charleston, W. Va., despatch states that the Board of Public Works has completed the assessment of railroad property in the State, and makes the total amount $13,083,941. Of this amount the Baltimore and Ohio Railroad and its branches contribute $6,524,597, while the Chesapeake and Ohio only contributes $2,558,16 . The total is estimated by about two-thirds of the actual value of railroad property in the State.

New R. R.—Gen. Spencer, ex-Treasurer of the New York, Lake Erie and Western Railroad, and his colleagues, who have been projecting a new railroad into Passaic City, N. J., in opposition to the Erie, in which they have been hindered by injunctions obtained by the latter, have bought the Veerland Farm, about 74 acres, in Passaic, which will enable them to build their own spur without delay and to hinder the Erie people indefinitely.

To Extend its Branches.—The Directors of the Nashville Chattanooga and St. Louis Railroad contemplates the extension of several important branches of the road. It is proposed to extend the Lebanon branch 20 miles to Carthage, and McMinnville branch 6 miles to the Bon Air coal fields, the Fayetteville branch 25 miles from Flora to Huntsville, and the Jasper branch up the Sequatchie Valley.

New Round House.—The New Round House of the Des Moines and Ft. Dodge R. R., at Des Moines, will be completed about October 1st. The building is of the best quality of Des Moines brick. Walls 18 feet to eves 1.5 thick with pilasters 15. × 15. inside 1.5 × 0.33 outside, at angles of back wall. The foundation walls are of Gilmore lime stone. Average depth below water table 10 feet, batter ¼ to 1 on both sides and resting on a footing course of same material projecting 0.5. The house will contain 6 stalls. Mr. L. N. Stearn, of Des Moines, has the contract for the masonry, and F. T. Nelson, contract for carpenter work.

New Railway Project.—Ex-Mayor Pratt, Oshkosh H. B. Harshaw, Frank Warden, Charles Leiber and John W. Hume are the incorporators of a new line of railroad which will run from Florence to Abbotsford, if the right of way over the Milwaukee & Lake Shore can be secured. The line will be a standard gauge. The capital is $1,000,000, and the road is to be known as the Wolf & Wisconsin Rivers Railway company. One thousand men are to be put at work grading and twenty miles of road will be completed by Dec. 1. Options have been secured on a great deal of valuable pine, and the road is to be built mainly to bring this product into Oshkosh.

The Short Line Railway.—Colonel Charles Snow, with Count Hauterwe and Mons. Kamper, of Paris representing the French syndicate who have contracted to build the eastern division of the Short Line railway from Moncton to Louisburg, were at the Royal lately. Mons. Charlier, C. E., inspecting engineer of the syndicate, is also of the party. The syndicate have behind them in their contract four of the wealthiest banks in Paris. The party left for Cape Breton to go over the proposed line of railway. Mons. C. G. Perrault, consul-general of France in Canada, accompanied the party. After their inspection of the route surveyed, the party will go to Ottawa to interview the government. The reporter was informed that the syndicate was prepared to enter into a contract with the government on the terms previously offered when Sir Charles Tupper was minister of railways.—*St. John Telegraph.*

Gulf Short Line and St. Louis Railroad.—GALVESTON, September 1st.—The Galveston & St. Louis Construction company have obtained control of the Gulf, Short Line and St. Louis railway, and will begin immediately to put the road in thorough condition, preparatory to making it a line of a trunk line from St. Louis to Galveston.

The St. Bernard Railway is likely to be commenced before very long. One of the principal features of the new project is that the indispensable tunnel under the Alps (at the Col Ferret) will be very much shorter than any other either constructed or proposed to be constructed. The length will be only 9¾ kilometres (5¾ miles), while the St. Gothard tunnel is 15, (9¼ miles), the Mont Cenis 12, (7¼ miles), and those under the Simplon and Mont Blanc 20 and 19 kilometres, (12 and 11¾ miles) respectively. The total length of the St. Bernard line will be but 138 kilometers, or 86 miles, making a saving between London and Brindisi over the St. Gothard route of 59¼ miles.—*Building News.*

A Standard Car Load.—Ten years ago a standard car-load on all first-class railroads was 20,000 pounds, the weight of the cars being 20,500 pounds. In 1881 the load on most roads had increased to 40,000 pounds, but the weight of the car had increased to only 22,000 pounds. The Master Car-builders of the Pennsylvania Road have now adopted cars to carry 60,000 pounds, while the weight of the cars will be very little increased. Instead of hauling more than one pound of car to one pound of freight, nearly three pounds of freight can now be hauled for one pound of car. The substitution of steel for iron rails has made the change possible.

Railroads in China.—A dispatch from Berlin states that China has contracted with a Manchester (England) firm for the construction of a railway from Token, at the mouth of the Hoën Ho on the Yellow sea, to Tong Chow, on the Peid Ho, an affluent of the Hoen Ho, at a point of about twenty-five miles east of Pekin. The railroad will be a most important work, about 100 miles long, and will give Pekin direct and easy communication with the Yellow sea. The road is to be built and operated by the Manchester firm, with Chinese labor and capital. China is now engaged in raising in Europe a loan of 10,000,000 florins to be expended on internal improvements.

Contracting.

The New Georgia Capitol corner stone was laid on September 2.

The Richmond, Va., Courthouse is to be enlarged at a cost of $100,000.

The Iron Interest.—PITTSBURG, PA., Sept, 3rd.—The sales of pig iron for the week past were the largest of the season, aggregating almost 9,000 tons.

Engineering in Wyoming is now mostly on Irrigation Works; some large projects being under way, and very many, unimportant in themselves, but aggregating largely in amount and results.

St. Patrick's Cathedral.—The contract for the completion of the spires of St. Patrick's Cathedral, N. Y., will be signed this week. The work will cost $190,000 and will be done by a Baltimore firm.

Montana Butte.—Citizens are talking of organizing a cable street railway.

The contract price for Helena's new court house is $137,999.50.

Rockaway's Big Hotel.—There is talk of organizing a stock company, with a capital of $1,250,000 to purchase and furnish the big hotel at Rockaway, Beach and open it to the public next summer.

A Hose Contract.—The town of New Lots, N. Y., has awarded to the Gutta Percha & Rubber Hose Co., of New York, a contract for 1,500 feet of hose at 80 cents per foot.

A W. Va. Bridge.—A contract for a 400 feet suspension bridge over Elk River, at Charleston, W. Va., has been awarded to J. W. Shipman, 59 Tribune building, New York.

Pittsburg, Pa. Contracts.—On September 3, Martin Joyce was awarded a contract for paving Laurel Avenue with "irregular blocks," at $1.19 per square yard. W. F. Patterson builds a 20-inch sewer, and Evan Jones a 24-inch sewer; prices not given.

Winnipeg Items.—Street paving is to be done to the estimated amount of $12,753. In the water system of the city, 6⅘ miles of pipe are laid, and 113 house services; there are two pumping engines of 35 horse-power each, and capacity of 1,728,000 gallons in 24 hours.

The Union Iron & Steel Co., of Chicago, which failed three years ago, will start again in November, with work for 2500 men. The company's real estate is worth $500,000 and the new buildings as much more. The new rail mill will use the "direct process."

New York Local Improvements Stopped.—Because of lack of appropriation contracts to the amount of $100,000 are effected in the Department of Public Works and $150,000 in the Park Department. No new improvements can be projected this year owing to Controller Loew's decision not to approve them.

The City Council of Davenport propose to light the city with electricity, and will advertise for proposals.

Bridge Bonds Wanted.—PUEBLO, COLORADO Sept. 1.—At the meeting of the County Commissioners on Monday next the board will be asked to have the people vote on the question of issuing $20,000 bonds for the construction of a bridge across the Arkansas on Union avenue.

Philadelphia Contract Items.—The Chief Commissioner of highways is authorized to advertise for proposals for street paving in West Philadelphia. The assessments on property holders on the line of the intended improvement is about $13,000 and the city will pay $3,000. Jones & Benner offer to take down the south line of trusses on the abandoned Market Street Bridge for $125, they to have the material; bid accepted.

The Baltic Canal.—Russia has sanctioned the plan for a projected ship canal which it is proposed to cut from Kiel, on the Baltic, to a point on the lower Elbe, near Cuxhaven, in the German Ocean. The entire cost of the work is placed at 156,000,000 marks, of which Russia stands ready to contribute 50,000,000 marks. The bill for the construction of this canal will be submitted to the Bundesrath after vacation.

Contracting Items.—The government contract for the removal of 50,000 yards of mud from New Haven, Conn., harbor, was on Monday awarded to Henry Dubois's Sons of Brooklyn, at eight and one-half cents per yard.

The contract for superstructure of the federal building at Concord, New Hampshire, has been awarded to Mead, Mason & Co., at $62,000, for granite and $22,000 for brick.

The bids for the completion of the Capitol building at Boise City, Idaho were opened recently. The lowest bid was $48,500, by Nimock & Co., to whom the contract was awarded.

The buildings in course of erection in Dallas, Tex., will cover $1,000,000.

Parties from abroad are in Albert Lea, Minn., canvassing with a view to putting in gas works. The proposition is to furnish private houses for $3 per thousand, and the street lamps of the city at $2.50 per month, or $30 per year for each lamp. The city council referred the matter to the city attorney to report at the next meeting.

Dayton, O., Contracts.—On Sept. 4th., the City Engineer reported that the 28,000 cubic feet of excavation in section 1 of the Park street sewer cost $679. The proposals for section No. 3, Park street sewer were as follows:

D. F. Minnehan, excavation	$ .75	$ .77	$ .65	$ .64	$ .63	$ .75	$	$ .55
Poock & Lauterbach, "	.60	.85	.87	.51	.49	.70		.51
Max Bodenmiller, "	1.00	.85	.90	.84	.87	.75		.83
John Paul, "	45.00	80.00	45.00	30.00	33.00	60.00		33.00
D. F. Minnehan, masonry, per foot	no bid	3.00	2.25	5.60	3.60	10.00		6.00
Poock & Lauterbach, " "	42.00	30.00	18.00	40.00	30.00	20.00		40.00
Charles Seifred " "	90.00	.40	.60	1.10	.98	.70		1.00
Max Bodenmiller " "	3.00	.30	.44	.80	no bid	.60		.75
John Paul, " "	3.00							
D. F. Minnehan, refilling, per yd.								
Poock & Lauterbach, " "								
Charles Seifred " "								
Max Bodenmiller " "								
John Paul, " "								

D. F. Minnehan, man hole No. 12, $40; No. 15, $40; No. 18, $40.

Poock & Lauterbach, man hole, No. 12, $70.40; No. 15, $108; No. 18, $128.

Charles Seifred, No. 12, $35; No. 15, $49; No. 18, $58.

Max Bodenmiller, man hole, No. 12, $35; No. 15 $40; No. 18, $45.

John Paul, man hole, No. 12, $119.80; No. 15, $197.50; No. 18, $212.30.

Entire work complete:

D. F. Minnehan	$24,350.00
Poock & Lauterbach	38,528.41
Charles Seifred	24,345.00
Max Bodenmiller	39,081.00

John Paul not estimated.

G. C. Gross's bill was not according to specification as to prices.

The combined bid of Charles Siefred is the lowest.

The Committee on Drains and Sewers report bids for section No. 2 of Park street sewer:

Work Complete.

D. F. Minnehan	$16,500
Columbia Bridge Works	17,000
Dud Stone	16,715
Poock & Lauterbach	18,313
Thomas Brown	16,450

	Excavation	Masonry.
D. F. Minnehan	$ 80	$8 00
Columbia Bridge Works	2 50	9 00
Poock & Lauterbach	2 00	8 00
Thomas Brown	50	7 00

Nos. 3 and 5 were informal, while 3, 2 and 1 were regular.

The bid of Thomas Brown was the lowest, and it was recommended that the clerk contract with him, and that the sum of $17,000 be aside for the work.

Bids for section No 1:

	Excavation.	Lumber.	Masonry.
Poock	$2 00	$27 00	$5 50
Siefred	2 45	20 98	5 85
Bodenmiller	75	26 00	6 00

	Culvert.	Refilling.	Hole No. 1.
Poock	$41 98	20	74 80
Siefred	53 35	30	57 00
Bodenmiller	52 27	25	70 00

Nos. 1 and 2 were complete; No. 3 was irregular.

St. Louis Contracts. On September 4, the Board awarded to W. F. Birch the contract for sweeping granite and wood streets, at 73 cents per 100 square feet; and to the St. Louis Street Sprinkling Co., the sweeping of asphalt streets at 50 cents per 100 square feet. The contract for masonry and interior iron-work of the Grand Avenue Bridge was given to Ed. Reilly at $104,885. Bids for sewer work were opened, and in the afternoon the contracts were awarded as follows: For constructing Mill Creek Sewer from Prospect Avenue to Cabanne street, Fruin, Bambrick Construction Company, $24,969.50; for constructing Mill Creek Sewer from Cabanne street to and on Vandeventer avenue to Duncan avenue, Fruin, Bambrick Construction Company, $7,129; for reconstructing sewer on Emmet street westwardly to a point west of twelfth street, J. Devlin, $2,113.50; for reconstructing sewers on Miller street, Broadway and Park avenue, from alley east of second street westwardly, J. Devlin, $2,996.60. The time for the execution of all the contracts has been extended to the 15th inst.

Bids on the State Sewer at Binghamton, N. Y.—Bids on the sewer from the State Insane Asylum at Binghamton, were opened by the trustees on Aug. 27th. The lowest bid, by Anthony S. Webb, was withdrawn by permission of the trustees, and the contract was awarded to the next lowest bidder, Arthur D. Osborn, of Binghamton. Mr. Osborn commenced work Sept. 1st., his time is limited to Nov. 1st.

Mr. Horace Andrews, the engineer in charge, has appointed Mr. John L. Fitz Gerald, of Schenectady engineer in charge of construction.

The bids in detail are given below:

Names of Contractors Bidding:—1. Thos. Darke & Sons, Buffalo, N. Y. 2. Anthony S. Webb, Syracuse, N. Y., (bid withdrawn). 3. Sherman & McDonough, West Troy, N. Y. 4. Benj. Van Vranken, Schenectady, N. Y. 5. Chas. O. Root, Binghamton, N. Y. 6. John Schultz, Binghamton, N. Y. 7. M. Hays and M. Tierney, Binghamton, N. Y. 8. Arthur D. Osborn, Binghamton, N. Y., (contract awarded).

BIDS ON UNIT OF MATERIAL, LAYING INCLUDED.

DESCRIPTION OF MATERIAL.	QUANTITY.	CONTRACTOR'S NUMBER. 1	2	3	4	5	6	7	8
10 inch vitrified pipe.	644 feet.	$ .69	$ .75	$ .77	$ .65	$ .64	$ .63	$ .75	$ .55
8 inch vitrified pipe.	2596 "	.56	.60	.85	.87	.51	.49	.70	.51
6 inch ½ inch cast iron pipe.	8522 "	1.00	1.00	.85	.90	.84	.87	.75	.83
Man Hole, complete.	9	45.00	25.00	80.00	45.00	30.00	33.00	60.00	33.00
Lamp Hole.	2	8.00	no bid	3.00	2.25	5.60	3.60	10.00	6.00
Valve in 6 inch pipe.	1	42.00	30.00	30.00	18.00	40.00	30.00	20.00	40.00
10 inch Y branch.	29	.75	3.00	.40	.60	1.10	.98	.70	1.00
8 inch Y branch.		.50	3.00	.30	.44	.80	no bid	.60	.75
AGGREGATE BIDS OF EACH CONTRACTOR.		$10993.12	$8405.00	$9826.74	$10102.42	$9485.16	$9548.70	$9276.30	$9211.42

		1	2	3	4	5	6	7	8
10 inch vitrified pipe.	644 feet.	$ 411.32	$ 483.00	$ 495.88	$ 418.60	$ 412.16	$ 405.72	$ 483.00	$ 354.90
8 inch vitrified pipe.	2596 "	1451.76	1557.00	1687.40	1479.72	1479.72	1272.04	1817.20	1323.96
6 inch iron pipe.	8522.00	8522.00	6035.40	7156.26	7789.80	7242.48	7501.14	6466.50	7156.26
Man Holes.	405. 00	405. 00	225.00	450.00	405.00	270.00	297.00	450.00	297.00
Lamp Holes.	5. 00	5. 00	no bid	6.00	4.50	10.00	7.20	20.00	12.00
Valve.	42.00	42.00	30.00	30.00	18.00	40.00	30.00	20.00	40.00
10 inch Y branch.	31. 00	31. 00	84.00	11.20	16.80	30.80	26.60	19.60	28.00
		$10993.12	$8405.00	$9826.74	$10102.42	$9485.16	$9548.70	$9276.30	$9211.42

The Colorado State Capitol.—On August 31st, the plan of E. E. Myers, architect of Detroit, Mich., was selected by the capitol commissioners as the first in place of the three to be picked out. The law provides that the cost of the building shall not exceed $1,000,000, and if the plan of Mr. Myers calls for more money when the bids, soon to be called for, are in, the plans will be rejected. The accepted plan has a frontage of 292 feet, a depth of 300 feet, and a dome 250 feet high. The design calls for smoothly dressed stone exterior. The Denver *Tribune-Republican* gives the dimensions of the accepted plan as 295 by 192 feet by 326 feet, extreme height, differing materially from the dimensions first given from the Denver *Daily News*.

Des Moines citizens want an intercepting sewer on the East Side.

American Iron for England.—ELK RAPIDS, Mich., Sept. 3.—The Elk Rapids Iron Company has received an order for 400 tons of charcoal iron, to be shipped to England, probably the first iron of Western manufacturing ever shipped from this country.

The Troy, N. Y. Dock.—John B. Marshall of New Baltimore has been awarded the contract for constructing the new dock for the Troy iron and steel company. The cost will be about $20,000 The dock will be 1,200 feet long and 13 feet wide. It will be laid with Georgia pine.

Montreal Harbor Improvements.—The local commissioners, feeling confident that the further expansion of the trade of the port is imminent, have been making great improvements in the harbor, and extending the accommodation at the wharves for shipping. Victoria pier is being carried out one hundred feet further, and widened fifty feet, when it will be 950 feet long with a width of 150 feet.

Electric Lighting Companies.—Two new electric lighting companies have been organized in New York, the points of operation, however, to be in Massachusetts. The first is to be known as the American-Edison Illuminating Company of Worcester, Mass., and the other having similar name, but for operation in Lowell, Mass. The companies have capital respectively of $100,000 and $50,000.

The contract made recently by the American Company, of New York, to light the entire city of Portland, Me., in which the American Company will use a large number of the Edison municipal incandescent lamps, was the initial work under the American-Edison compact made in the early part of the summer. Central lighting stations are now to be introduced into Worcester and Lowell, Mass., and it is understood that the American Company is now laying its plans for general street lighting in every city in New England.

Index to Periodical Literature.

Car Truck.—*Six Wheeled Equalized Truck.*—Two spiral and two half elliptic springs are used for equalizing, being connected by levers resting on the axle-boxes. The frame is of iron 4 inches by 1¾ inches, wheel-base only 7 feet 8 inches with 33-inch wheels. Illustrated. *National Car Builder*, September, 1885, pp. 121, 122.

Locomotives.—A brief description of some European engines. A tank engine of the Western R. R., (France),—six wheels, all coupled, 5 feet diam., inside cylinders 16 inches by 24 inches, weight 40 tons. An express engine of the Orleans R. R., (France), —driving wheels 6 feet diam., cylinders 18 inches by 24 inches, weight 44 tons. An express engine of the Belgian State Railways,—four coupled wheels 6 feet, 6 inches diam., single pair of leaders 4 feet diam. inside cylinders 17 inches by 24 inches, weight 43 tons. Others are mentioned. Illustrated *Le Génie Civil*. August 8, 1885, pp. 233 to 236.

Street-Railroad Locomotive.—A small four-wheeled all coupled engine for the Java tramways. Gauge 3 feet 6 inches. Wheels 3 feet diameter. Inside cylinders 8¼ inches by 11½ inches. Height of smoke stack from rail 10 feet. Joy valve gear. All boxed in. Weight 12 tons. Detailed drawings are given. *Le Génie Civil*. Aug. 8, 1885, p 234.

Railroads.—*Mountain Railroads.*—An article refuting the claims of the Ceylon railway to first place. A list is given of several American, Mexican, and European roads with notes on the grades, curves, works and other details. *Railroad Gazette*, August 28, 1885, p. p. 551, 552.

Steam Engines.—*Electrical Regulation of the Speed of Steam Engines and other Motors for Driving Dynamos.*—Refers to the causes of irregularities, and states that centrifugal and other electrical governor are inferior in every way to electrical governors. Mentions the various inventions and describes in detail the Willans Electric Governor. Illustrated. A discussion is appended. P. W. Willans. *Min. Proc. Inst. C. E.* Session 1884-85. Vol. lxxxi., part 3.

Street Railroad Locomotive.—(*See* Locomotive).

Telegraphy.—*The New System of Telegraphing to and from Moving Trains by the Use of Electric Induction.* A paper read before the Franklin Institute, May 20, 1885, by P. H. Van der Weyde. Describes the principles of induction, the methods of communication of the Phelps system, and the necessary fittings and instruments for track and cars. Illustrated. *Journal of the Franklin Institute*. September, 1885, p. p. 165 to 177.

Water Waste.—*House to House Inspection to Prevent Water Waste.*—M. L. Holman, read before Engineers Club of St. Louis. Describes a rigid system of inspection adopted in St. Louis to check flagrant waste, and the methods of carrying out the tests. Tables are given of the operations of the inspectors, and of the average consumption. *Journal of the Assoc. of Eng. Societies*. August, 1885, p. p. 368 to 374.

Recent Patents.

Machine for Clearing the Sides of Railroad Tracks.—*D. M. Harris, Alberdeen Miss.*—A truck has horizontal toothed bars at right angles to the track, which work by the revolutions of the truck wheels, and cut down all brush and weeds, etc. No. 325, 340.

Railway Construction Train or Carriage.—*B. H. Hill, Lowell, Mass.*—A long flat car has a track on each side for small trucks, and has an arrangement of arms at the rear for lowering the rails on to the road bed. The trucks and handling apparatus are driven by an engine on the forward end, said engine also driving the forward car truck wheels. No. 325, 246.

Railway Rail Joint.—*Cyrus Taylor, Denver Col.*—One splice plate is thickened at the middle, a bolt passing through this portion, and between the ends of the rails. No. 325, 458.

Rotary Pump.—*Francis M. Roots, Connersville, Ind.*—Consists of rotating pistons of such dredging as to remain in contact during their revolution. No. 325, 276.

Rotary Water Meter.—*John Rowbotham, Philadelphia, Pa.*—A slotted drum has vanes sliding in the slots, and two intermediate eccentric surfaces, with recesses into which the parts open, so arranged that the vanes are under an equilibrated pressure. Nos. 325, 361, 325, 362.

Swing Bridge.—*Marcus O. Anthony, Bay City, Mich.*—The bridge is provided with an apparatus for operating a gate pivoted on the stationary part of the bridge, and worked from the centre of the draw. No. 325, 472.

Trade Notes.

THERE is no longer any doubt that the bottom has not only been reached in business stagnation, but that several steps have been taken toward an era of prosperity. Croakers have now the inestimable privilege of keeping quiet. Labor is finding employment, and that is the keystone to good times.—*Iowa State Register.*

WITHIN the past week the improvement has become more general. The inquiry for pig iron has increased, and one sale at New York is noted of 7,000 tons of forge at $15, for which $14.50 had been offered. While none in the trade admits the liklihood of a boom, all appear satisfied that there is a better business in sight. Dealers in Scotch pig have advanced prices 5cc. per ton, and orders have been cabled in some instances for shipment to this port. Steel rails for moderate sized lots may be had at $28@$28.50, while smaller quantities command $29. No large orders extending in delivery beyond January 1, will be taken at these figures. One small lot for prompt delivery has been sold during the week at $32, furnace delivery. These are very encouraging features. Scotch pig at Glasgow is 9d. @ 1 s. higher, with some speculative buying.—*Bradstreets*, Sept. 5.

IRON TO BE SHIPPED TO ENGLAND.—ERIE RAPIDS, MICH., Sept. 3.—The Elk Rapids Iron Company have received an order for 400 tons of charcoal iron to be shipped to England, probably the first iron of western manufacture ever shipped from this country.

Market Report of Engineering Materials.

New York, September 10, 1885.

NOTE.—The following Market Report gives wholesale prices on the New York Market unless otherwise stated. It is intended as a general guide to the estimating engineer, and both the range of material and the market location will be extended as rapidly as possible. We give it with this caution, that, as is well understood in business transactions, the amount of bill, distance from market centre and conditions of payment will have a material influence on the final paying prices.

IRON.

STRUCTURAL IRON.			
Angles	1.9c.	@	2.2c.
Tee	2.2	@	2.4c.
Beams and channels	3.0c.	@	
Tank	2.	@	2.1c
Shell	2.4c.	@	2.5c
Steel plates, Tank	2¾c.	@	3c.
WROUGHT-IRON PIPE., PITTSBURGH.			
Butt welded, black ..... Discount	42½	@	45
" " galvanized ..... "	35		
Lap welded black ..... "	60	@	62½
Galvanized ..... "	45		
Boiler tubes	57½		
RAILS.			
Steel (large lots at mill)	29.00	@	30.00
Old rails	19.00		
Old rail steel	17.00	@	18.00
R R. spikes	1.8	@	1.9
R R. splice-plates	1.55	@	1.7.
R R. Track Bolts Square Nuts	2.75	@	3.00
Barb-wire fencing, galvanized	4¾c.	@	5¾c
" " painted	3¾c.	@	4¼c.
Corrugated iron			
Nails			
Iron	2.35		
Steel	2.40.		

METALS.

COPPER.			
Lake Superior	11½	@	11¾
Other Brands	10¾	@	11⅛
LEAD.			
Com. Domestic	4.25		
Lead Pipe	.05¾		
Tin-Lined Lead Pipe	.15		
Sheet Lead	.06¾		
ZINC.			
Sheet	5¼	@	5½

BRICK.

(Cargoes afloat)			
Haverstraw ..... per M.	$6.00	@	6.25
Fishkill			
Up-River	5.37	@	6.00
Jerseys	4.62	@	5.75
Long Island			
" pale	2.75	@	3.25
FRONTS.			
Croton red	11.00	@	14.00
" dark	11.00	@	14.00
" brown	10.00	@	13.00
Philadelphia pressed	24.00	@	25.00
Trenton "	24.00	@	25.00
Baltimore "	37.00	@	41.00
Buff "	33.00	@	35.00
Enameled English	65.00	@	130.00
" American	85.00	@	120.00
Fire brick	25.00	@	40.00

CEMENT.

PORTLAND.			
Gibb's English 400 lbs. per bbl	2.75	@	2.90
K. B. & S. " "	2.85	@	3.00
J. B. White & Bros., Portland Cement	2.65	@	3.00
do Keene's Superfine,	8.00	@	10.00
do " Coarse,	5.50	@	6.00
Roman	2.75	@	3.50
Largerdorfer German "	2.55	@	2.80
Dyckerhoff, " "	2.90	@	3.25
Stettiner " "	2.60	@	2.65
Hanover " "	2.60	@	2.65
Vorwohler, Lion "	2.90	@	3.25
Alsen, " "	2.55	@	2.60
Fieve "	2.40	@	2.50
Saylor's American	2.15	@	2.40
Windsor } U. S. C. Co.	1.00	@	1.10
Standard }			1.15
Cable's Portland }	2.15	@	2.40
F. O. Norton			1.10
ROSENDALE cements	90	@	1.00

LIME.

Rockland common per bbl	1.00		
" finishing	1.20		
State, common	.90		
" finishing	1.10		
Kingston, ground	0.95		
Add 25c. to above figures for yard rates.			

STONE.

Cargo rates at New York.

Amherst freestone, No. 1 per cub. ft.	0.90	@	95
" " No. 2 "	0.75	@	0.80
" " light drab "	0.80	@	0.95
Berlin " in rough "	0.75	@	1.00
Berea "	0.75	@	1.00
Brownstone, Portland, Ct. "	1.00	@	1.30
" Belleville, N. J. "	0.75	@	1.25
Granite, rough	0.60	@	1.25
Common building stone per load	2.00	@	3.00
Base stone, from 2¼ to 6 ft. lengths, per lin. ft.	0.40	@	3.00

SLATE.

Purple roofing per square	6.00	@	7.00
Green "	6.00	@	7.00
Red "	15.00		
Black Penna. (at New York) "	4.50	@	5.00

LUMBER.

Prices for yard delivery in New York.

PINE, Common box per M.	18.00	@	20.0
" Choice "	55.00	@	80.
Tally plank, 1¼ in. 10 in. dres'd. each.	.44	@	.50
Tally boards, dressed com. "	.28	@	.30
SPRUCE, Boards dressed "	.25	@	.28
Plank, 1¼ in "	.28	@	.30
" 2 in. "	.38	@	.40
" 2 in. dressed "	.43	@	.45
Timber per M.	20.00	@	22.00
HEMLOCK, Boards each.	.18	@	.20
Joist, 2½ × 4 to 4 × 6 in	.17	@	.44
OAK per M.	55.00	@	65.00
CYPRESS 1, 1¼, 2 and 2¾ in "	35.00	@	40.00
YELLOW PINE, Girders "	25.00	@	30.00
Dressed flooring "	28.00	@	35.00
SHINGLES, Extra shaved pine, 16in. "			
" sawed 18 in. "	5.75	@	6.00
LATH, Cargo rate	2.10	@	2.25

PAINT.

Lead, white, American dry per lb	.04¾	@	.05
" " " in oil pure "	.05½	@	.05¾
English, B. B. in oil	.08¼	@	.08¾
Red, American	.05½	@	.05¾
Litharge "	.05	@	.05¼
Venetian red, American "	.01	@	.01¾
Indian red "	.05	@	.10
Vermillion, American lead "	.11	@	.11¾
Paris green "	.15	@	.19
Umber, Amer. raw and powdered per lb.	.01¼	@	.01¾
Drop black, Amer.	.08	@	.12
" "	.09	@	.11¾
Chrome green	.05	@	.15
Oxide zinc, American	.03¾	@	.04
" French	.06¼	@	.06½

A Big Contract for Engines and Coaches.—CHICAGO, Sept. 3.—The Chicago, Burlington and Northwest Railroad contracts, aggregating $1,500,000 were let today. Thirty-five engines will be built by the Rock Island (Ill.) Locomotive Works. All the coaches are to be constructed at Pullman.